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## CONTENTS.

☞ An asterisk (*) denotes an illustrated article


How to Obtain Copies of the Photograph Taken at the Boston Meeting..... 241

EDITORIALS—

The Outlook..... 241
Sudden Death of W. R. Thomas..... 242
The "Engineering News."..... 242
A Radiating Gas Heating Stove..... 242
Age of the "Square"..... 242
Proceedings Ninth Annual Meeting of American Gas Light Association..... 243
Report on New York Water Supply..... 250
The Water Supply of the City..... 251
Discovery of a Well of Natural Gas in Cincinnati, Ohio..... 252
Fire Caused by the Electric Light..... 252
The Krupp Gas Producer..... 252

CORRESPONDENCE—

The Control of Gas to the Point of Consumption..... 252
Niagara Falls as a Source of Energy..... 253
Preparation of Pure Phenol..... 253
Improvement in Compasses..... 253


## How to Obtain Copies of the Photograph Taken at the Boston Meeting.

OFFICE OF THE CHARLESTOWN GAS CO.,
THOMPSON SQUARE, CHARLESTOWN DIST.,
BOSTON, Nov. 9th, 1881.

Members of the American Gas Light Association, and others, wishing for copies of the picture of the "Group of Gas Men," taken at the works of the Boston Gas Light Company, Oct 20th, 1881, are requested to forward their orders for the same to the undersigned, with $1.50 for each copy desired.

GEO. B. NEAL,

*Charlestown, Mass.*

## THE OUTLOOK.

As the closing days of the year approach, and the maximum daily make for this season is being reached, it cannot but be evident to all that the year's business has been more satisfactory than for a number of years back. From all sides we receive the most cheering assurances of an increase of send-out over last year. The general condition of legitimate business seems to be characterized by a strong, healthy and steady activity. Those who have in times past been uneasy as to the future of gas investments, owing to the several competing systems for lighting that have been promised, and, to a certain extent, introduced, should feel reassured, if they take in the whole field of operations. The steady increase that is manifested in the amount of gas consumed should convince people that as yet the limit of extension has not been caught sight of. A short time since we gave some figures as to the amount of business being done in London alone, and the rate of increase thereof. This year's working thus far is developing an increased demand upon the companies there which even the boldest projectors of works for future supply have not anticipated; and if present indications are any guide for the future it is simply a matter of continuous building of works as fast as possible for years to come.

So great is this pressure upon some of the managers that it is reported that many of them would rejoice if the new systems of lighting would take the increase of their business, and allow them a little time to devote to gas making, instead of keeping them constantly harassed, as at present, in devising plans for works and securing their completion in time to meet the demand.

The increase of light resulting from the use of electric lights, wherever they are in operation, makes an increased demand for gas light in the neighborhood. An establishment that had placed several electric lights in front of their place of business supposed they could dispense with gas in their windows. A few night's experience served to dispel this delusion, for the effect was found to be very similar to that of a full moon outside of the building, which was very beautiful and charming in itself, but did not serve to display to good advantage the beautiful materials spread out for public inspection in the windows of the establishment; and, consequently, while the electric light shed its effulgence upon the outer air the gas jets resumed their sway within.

Upon this point we would call the attention of our readers to some remarks made by a distinguished French electrician, in an address recently delivered, at the Electric Exhibition in Paris, to the French Association of Gas Engineers, who held a special meeting in Paris last September for the purpose of witnessing this Exhibition.

Among other distinguished electricians who were invited to deliver addresses and explain the progress of the application of electricity to lighting was Mr. Frank Géraldy, who gave a most interesting paper upon the distribution of electricity. After stating the advantages of electricity, he asked the question, "What will be the consequence from the gas standpoint?" and answered the question as follows:

"I do not believe it will be detrimental. In fact, gas and electricity are not destined to fill the same offices. Electricity will doubtless take large spaces, and perhaps limited spaces where an intense light is wished; but, in my opinion, it cannot be substituted for gas in the great part of the service which gas renders—nor replace the small lights, either for heating or

lighting. It is evident that where a powerful light is demanded electricity may be preferred, but where we require a medium light well-diffused gas will be preferred. * * * *

"The incandescent lights, curious without doubt, very pretty and very ornamental, are not, unhappily, an economical solution of the lighting question, and will probably remain confined to installations of luxury."

Many other distinguished electricians have publicly and privately uttered similar *truths;* and so far from deprecating the extension of electric lighting we would prefer to see the practical utility and cost of the light clearly demonstrated by a working application large enough to show clearly what it costs to make and to distribute. On the other hand, as concerns the gas business, we would earnestly recommend a closer attention to its details and its economies, and, above all, to making adequate preparation beforehand, and in season, for the increase that is sure to come faster and larger than it ever has before. Be prepared to give all that is demanded under the best conditions of price and pressure for any purpose that may present itself. The gas engine is in its infancy, the next 10 years will witness many improvements in its construction, and a vast increase in the number of its applications, while for heating and cooking the field yet unoccupied is simply enormous. The new year certainly bids fair to open with a good business, and every prospect for its continuance.

Good quality and a low price, yielding reasonable returns upon capital actually invested, will go far to make the increase of business permanent and the profits sure.

## Sudden Death of Mr. W. R. Thomas.

The many friends of Joseph R. Thomas, Engineer of the Williamsburgh Gas Light Company, will hear with deep regret that he has been called upon to mourn the sudden death of his son who, for a number of years, has been employed as an assistant to his father at the Williamsburgh works. About four years since Mr. W. R. Thomas received a severe blow upon the head from which he had suffered more or less ever since. At times the pain would be most intense, and relief was obtained, under medical advice, by the use of chloral. However, it seems that, at times, this seemed to fail, and leeches and bleeding had been found to give relief. At the time of his death there seems no doubt, from abundant testimony, that the young man was suffering intensely, and endeavored to get relief by bleeding himself. There is no evidence of any kind that would tend to show that he had any intention of taking his own life, for when he was found, quite dead in his room, the incision which he had made in his arm was thoroughly closed, and the flow of blood stopped by the application of a tight bandage, and the amount of blood which had flowed was found in a basin, and did not exceed a-half pint. The idea is, that being in a prostrated condition from excessive suffering he swooned, or fainted, after having bound up his arm and, no one being present to apply restoratives, he did not come out of it alive, but passed away in the fainting turn. We give below the proceedings of the coroner's jury in the case, as published in the Brooklyn *Times*, Nov. 22d. The most sincere sympathy will be felt for the father of the young man by all who know him.

"Coroner Parker last evening held an inquest on the body of William R. Thomas, lying at the residence of his father, No. 1 Bedford avenue, who, it was supposed, had committed suicide while under temporary aberration of mind, produced by melancholia. The only evidence taken was that of Dr. T. C. Giroux, who was called to the house at 70 Marcy avenue upon the discovery of the dead body last Saturday night. His evidence entirely upset the hypothesis that Thomas had deliberately taken his own life.

"The affidavit of Dr. Giroux was as follows: I am a practising physician; am personally and intimately acquainted with the deceased, having been his medical adviser for the past two years; was called to attend him on Friday evening, November 18, 1881; found him suffering from nervous prostration; his breath had the odor of opium; a careful examination satisfied me that he had not taken enough to produce any ill effect; when spoken to, he would answer rationally, saying that he wanted to be bled and then allowed to go to sleep; his pulse was regular and strong at 98, no faster than is usual in men who are in the habit of using stimulants; the pupil of the eye was not abnormally contracted; left directions with his wife how he should be cared for during the rest of the night, promising to call in the morning; called at 10 A.M., but could not see him; he had locked the door and would not admit any one; he was found dead at about seven o'clock, P.M. From my intimate acquaintance with his trouble and the relief produced by bleeding on several occasions, it is my firm conviction, as his family physician, that the deceased never attempted suicide, but, on the contrary, tried to relieve the pressure on his brain by bleeding himself. When perfectly sober he would always complain to me of severe headaches. I therefore state as my conviction, based on my knowledge of the deceased, that the cause of his death is great prostration and loss of blood produced by his effort to relieve his head. I wish to mention that some years ago he received a heavy blow on the head and from that time he suffered more or less from cerebral trouble.

"On this evidence the jury brought in the following verdict—

"The jurors find that Wm. R. Thomas came to his death on the 19th of November, 1881, by exhaustion superinduced by loss of blood caused by cutting the arteries of his left arm in an endeavor to alleviate a pain in the head from which he was then suffering."

## The "Engineering News."

The rapidly increasing business of this excellent paper has necessitated a change in its business management, and the proprietor of *Engineering News* has reason to congratulate himself in having been enabled to secure the editorial services of such an able Engineer as Colonel Julius W. Adams. Colonel Adams will hereafter have the editorial control, Mr. Frost still continuing proprietor and business manager. Col. Adams's salutatory speaks for itself—and is as follows:

"The undersigned, in assuming the editorial management of *Engineering News*, has counted on his numerous professional brethren being as interested as himself in the dissemination of correct information in relation to our public works of all kinds; that the facts and figures shall be accepted as reliable, it is desirable that the sources of this information shall be unquestioned—that is to say, that the engineer in charge of constructions shall think it worth his while, if not to write himself, to cause to be written, a correct statement, however brief, of results attained, as "engineering news" of interest to our readers, and not without value and service to the engineer himself; we should also be pleased to give space to original articles from engineers embodying their views, plans, or criticisms in relation to existing or contemplated improvements, and however they may differ from the views of the Editor, they will be not the less welcome, and we trust the writers will never have occasion to question the fairness with which their communications have been treated. J. W. ADAMS."

## A Radiating Gas Heating Stove.

M. Lebreton has invented a gas-heating stove, which he calls a thermo-condenser, and for which very considerable advantages are claimed. The apparatus may be used in conjunction with stoves consuming any kind of fuel, but it is of use chiefly when gas is employed, because it is intended to render available the greater part of the heat contained in the products of combustion.

The stove consists of two parts, the lower being simply a combustion chamber, of no special design, while the upper portion, which is the thermo condenser, consists of a number of tubes of thin copper, forming a multiple chimney. These tubes are made with projections or ornaments, intended to expedite the cooling of the smoke-vapors, and to greatly multiply the radiating surfaces. The inventor prefers to make the tubes spiky, similar to pine branches. With a stove of this construction M. Lebreton carries the condensation of the combustion gases to such a point that the condensed water contains most of the impurities which would otherwise be sent into the outer air.

He claims to dispense with a chimney, and to preserve from contamination of burnt gases the air of the apartment heated by the stove. After heating for 9½ hours a room of about 80 cubic meters capacity, to a temperature of 20° to 21°C. (68° to 70° Fahr.), the outside temperature being 10° or 11°C (50° to 52°Fahr.), analysis of the gas within showed only 7 parts in 10,000 of carbonic acid. The gas was consumed at the rate of 160 liters (5.6 cubic feet) per hour, or 1550 liters (52.2 cubic feet) in all. The thermo-condenser was in constant use by M. Lebreton during last winter.—Lon. *Journal of Gas Lighting.*

## Age of the "Square."

Among some tools found in a temple at Thebes was a square, which is the most satisfactory evidence we have of the early use of this instrument. From marks upon it, it has been estimated to have been made nearly 35 centuries ago. Since the arts in Egpyt at that time were at the height of their development, the square must have been known for some time previous, and therefore it is believed that the use of the square dates back not less than 4000 years. The square known to the ancients, and the tool with which they accomplished marvels of construction and calculation, was not, by any means, the square known to mechanics of the present day.

This instrument as now employed, with blade and tongue and heel and the graduated lines which appear upon its surface, is an invention known only within a comparatively short time. The square, as an instrument, has only been brought to its present state of perfection within a very few years. —*Iron Age.*

[Official Report.—Continued from page 225.]

## Ninth Annual Meeting of the American Gas Light Association.

Held at the Hotel Brunswick, Boston, Mass.,

Oct. 19, 20, and 21, 1881.

### Afternoon Session—Oct. 19.

#### NOMINATION OF OFFICERS.

Mr. Denniston, from the committee appointed to nominate officers for the ensuing year, made the following report:

Your committee, to whom was assigned the duty of nominating officers for the ensuing year, have instructed me to report as follows: They did not find the duty quite so simple as they had anticipated, in consequence of their desire to meet the wishes of the Association, and also, to some extent, distribute the offices geographically. The committee present the following names:

*For President*—Gen. A. Hickinlooper, Cincinnati, Ohio.

*For Vice-Presidents*—Theobald Forstall, New Orleans, La.; W. A. Stedman, Newport, R. I.; Eugene Vanderpool, Newark, N. J.

*For Secretary and Treasurer*—Wm. Henry White, New York City.

*For Finance Committee*—A. B. Slater, Providence, R. I.; G. S. Hookey, Augusta, Ga.; W. H. Miller, Columbus, Ohio.

*For Executive Committee*—A. C. Wood, Syracuse, N. Y.; T. Littlehales, Hamilton, Canada; F. C. Sherman, New Haven, Conn.; Samuel Prichitt, Nashville, Tenn.; J. H. McElroy, Pittsburgh, Pa.; M. S. Greenough, Boston, Mass.

Your committee, in consequence of some of the questions which presented themselves in making the selection, would suggest some changes, which, if adopted by the Executive Committee and the Association, will simplify the labors of succeeding nominating committees, to some extent at least.

We therefore recommend, and ask to have referred to the Executive Committee, a change in the By-Laws or Constitution of the Association, making the office of President elective annually, and that the holder of the office shall not be eligible for immediate re-election.

Also, that the office of Secretary and Treasurer be separated, and that a Secretary and a Treasurer be elected annually.

I may also state that our present honored President positively declined a re-election; and further, that Mr. M. S. Greenough protested that it was not in good taste for members of the committee to nominate themselves to office, and that he was nominated for the position without his vote.

Respectfully submitted,

W. H. Denniston, *Chairman.*

Mr. Denniston—I now move that the Secretary be directed to cast the vote of the Association for the persons named for the several positions; and if there are any changes desired, it will be developed by the vote on this motion.

Mr. How—I will second that motion, although I think the proper order would be to first accept the report of the committee, and then act upon their recommendations.

The President—Of course, the regular order would be to first accept the report.

Mr. Denniston—Then I will withdraw my motion for the present.

On motion of Mr. How, the report as read was then accepted.

Mr. Denniston—I will explain that these recommendations are simply the recommendations of this Committee, and were made because they found some difficulty in the selection of men—not, I am happy to say, because there were not plenty of men in the Association who would fill any of the offices with honor, but because there are so many men eminently qualified for any of the positions, and so few positions to be filled. We simply desired our recommendations to be referred to the Executive Committee, in order that they may come before the Association in proper form next year. I presume that it is entirely proper for this Committee to suggest to the Executive Committee these changes, which will to some extent, simplify the duties and labors of coming committees. If the recommendation as to the annual election of officers be acted upon, then succeeding nominating committees will know that a new man is to be selected each year for the office of President.

The President—Then you mean to propose that the President shall not be eligible for re-election?

Mr. Denniston—That is the idea. It is not expressed in the best form; but it is for the Executive Committee to put it into proper form, if they favor the recommendation. When they bring it before the Association for action, they will say what rule will be affected by the change. The object is to have a President elected annually. If they suggest and we adopt such change in our By-Laws, it will then become mandatory that there must be a new man for President each year. We have already arranged for a change of one member of the Finance Committee and of two members of the Executive Committee each year; and this will necessitate a change of President also.

The President—I think that a change of this kind is very proper and desirable. I had no intention last year of accepting a renomination. After having held the office for two years, I thought that someone would certainly be selected to take my place. I said at Chicago that I did not ask to be renominated, but there was an indisposition to excuse me, and so I accepted the office, though somewhat reluctantly. I came here this time determined not to accept it again. If there is any special capacity required for the performance of the duties of the office, there is an abundance of that special capacity to be found among the members of the Association; and the office ought not to be continually held by one man.

Mr. How—We have accepted the report, and I now move that the recommendations of the Committee be adopted.

Mr. Harbison—I think that it is better to let the Executive Committee properly prepare and present this matter to the Association, than to act on it on the impulse of the moment. It is a very important matter. Let the Executive Committee carefully consider it and present it to the Association in the proper way and at the proper time for action.

The President—I do not think we have the right to adopt the recommendations and give them the force of law without incorporating them into the Constitution or By-Laws.

Mr. Cabot—If in order, I would amend Mr. How's motion by suggesting that we divide the report, and proceed to adopt the first part, relative to the election of officers, and that the recommendations of the other part be referred to the Executive Committee, to report at a later day how the By-Laws can be amended so as to carry out the suggestions of the nominating committee.

The President—That is substantially what has been already ruggested.

Mr. Denniston—It has been suggested that this matter should properly go to the Executive Committee. It was not intended that there should be any discussion at this time. When the recommendation is put in shape by the Executive Committee, and by them brought before the Convention, it can be discussed; but not now.

Mr. Harbison—I think we have no choice in the matter. Article 33 of the Constitution reads:

"All propositions for adding to or altering any of the provisions of the foregoing Constitution shall be laid before the Executive Committee, who may bring it before the next general meeting of the Association if they think fit; and such Committee shall be bound to do so on the request in writing of any five members of the Association."

Mr. How—That is just what my motion was intended to accomplish. I understood this Committee to recommend that the whole subject be referred to the Executive Committee for consideratton and action. I moved that that recommendation be adopted. I understand that this is in accordance with the By-Laws. It is not to be acted upon by the Asssociation until the Executive Committee make their report at the next meeting.

The motion of reference to the Executive Committee was then agreed to.

The President—It is now plainly our duty to proceed with the election of officers.

Mr. How—I second the motion made by Mr. Denniston, that the Secretary *pro tem.* be authorized to cast the ballot of the Association for the gentlemen nominated by the Committee for the several offices.

The motion was agreed to.

The President appointed Messrs. Denniston and Heime tellers.

The Secretary cast the ballot of the Association as directed.

The tellers presented their report, and the President thereupon declared the gentlemen named by the nominating committee to have been duly and unanimously elected to the several offices.

#### NAPHTHALINE IN PIPES AND SERVICES.

Mr. How—At the meeting of the Association in New York several years ago, the subject of naphthaline and the stoppage of mains and services was introduced. Mr. Stedman made so interesting and suggestive a report with regard to the results obtained by the use of the hot scrubber that I hope he will give us a little information in relation to that subject, and its action upon pipes and services, and the general distribution for street lamps. It would be of great interest to us just at this moment, although it may be a worn-out subject. I know that it has been handled so many times that some people are weary of it. But when we have a report of not less than 2,000 stoppages in the district which the old Brooklyn Gas Light Company controls, it becomes a matter of interest to the Company to know how to avoid the difficulty. His results are surprising. Does his method help that in any respect? I would like some information on the subject.

The President—This subject can never be old so long as some gas managers are tormented with naphthaline. I hope, therefore, that the Associa-

tion will join with me in asking Col. Stedman to tell us all he knows about his hot scrubber, and about its effect in the direction that Mr. How has suggested.

Mr. Stedman—You do me a great deal of honor in calling me up to talk on this subject; but I am in the position of introducing a gentleman to a party with whom he is much better acquainted than I am. This 2000 stoppages from naphthaline is something I have never had in my own experience, although I have been troubled with naphthaline to some extent; and I can honestly say that I think the application of the hot scrubber is a preventive of it in a very great measure. Before we used the hot scrubber we had to keep on the alert all the time, particularly at the inlet and outlet pipes, to keep the gas-way free. If I recollect rightly, the experiment of partially distilling tar from the hydraulic main in this scrubber (the distillation being effected by a coil in the bottom of the scrubber) commenced some time in May last. We had a recurrence of the naphthaline trouble in the spring, and after that we got through the summer without any recurrence of it whatever, neither pipe being stopped up. We do not ordinarily have so much trouble in the summer; but I think that we never passed through a summer that we did not clean out the pipes at least once a fortnight. Our method is to fill them full of water, so that it will run out through the pipes. Then we put steam in and boil the water for a long time, and let the condensed steam keep running out through the horizontal inlet and outlet pipes; and the contents of the condensed water from the pipe drips through an outlet that is made for the purpose into the cellars of the purifying house, where the pipes go from the meter. Last summer, after we commenced doing this (however incredulous our Brooklyn friend may be—and he is afflicted with inherent incredulity), we did attain a very remarkable increase in the illuminating power of the gas. Before that we were using some 7 or 8 per cent, of cannel, and we reduced the quantity until we found that it was entirely unnecessary to use any. Our record shows that during June, July, and August we used Kanawha coal alone, and kept up the full average of 18-candle gas, making from 5 to 5.10 feet per pound. We have run higher yields than that, but we found that we got our best results by restricting the yield to 5 or 5.10 feet per pound. This fall, after the weather commenced to be cold, and since the first of October, we had a cargo of Youghiogheny coal, and commenced using it. We began presently to get more trouble from the naphthaline, and did not get quite as good results as from the Kanawha coal, and so we used a little cannel. On three or four occasions we had to clean out the pipes at the inlet, and we had three or four stoppages in the services. There were two very remarkable cases where the stoppage did not occur in the services, but in the pipe inside of the house, where there was an evident rise of temperature above the temperature at which the gas came in through the service pipes. These two cases occurred in houses situated not 200 feet apart. The pipes ran near the furnace, and there was some heat imparted to them from the furnace. Notwithstanding the services were certainly clean, these pipes in the two buildings were filled up with naphthaline in solid flakes, so that scarcely any gas could pass. We had before known of naphthaline accumulating in pipes which were sensibly warm to the hand because of their proximity to a furnace. The pipe stopped up so persistently that after cleaning it out six or eight times we were compelled to move the pipe, in order to get the gas through it. I am not prepared to give any very great amount of experience in the use of naphthaline, because I only deal in it in a very small way. But as regards the hot scrubber, I am satisfied that it was a benefit to us, both in raising the candle power and in reducing the trouble that we previously had from the naphthaline. I think one fact may possibly be the explanation of the other—that the rise in candle power may have been the reason that the naphthaline was carried along to the burner instead of being deposited in some of the pipes. It is a pretty generally received theory that the better the naphthaline the higher will be the candle power of the gas.

Mr. Harbison—About the time that you introduced the hot scrubber did you change the kind of coal you had been using?

Mr. Stedman—From the first of December to October we used the same Pittsburgh coal.

Mr. Harbison—but you used the Youghiogheny coal before using the hot scrubber?

Mr. Stedman—Yes.

Mr. Helme—I would like to hear from Mr. Sherman. He has been using one of the same kink of scrubbers Mr. Stedman speaks about.

Mr. Sherman—I would say, in regard to the scrubber, that I found the record of our company previous to my taking charge of the works, and what I have to say will refer to that record. I found that the Smith & Farmer scrubber was put up the year previous to my going to the works. They put it up in order to relieve themselves from the naphthaline. The books show that in the year previous to putting up the hot scrubber they had 50 complaints a day, because of the naphthaline, from 600 consumers. At no time within the last six years have we ever had over 12 complaints or orders to relieve pipes from naphthaline. This shows a very great improvement in this direction. Our mains in the streets never give us any trouble from the accumulation of naphthaline. We have some trouble about the works; but whatever naphthaline is made there is deposited about the works.

The President—Not in the services?

Mr. Sherman—The trouble was formerly in the services. Of course, we had rather take care of the naphthaline at the works than have our customers annoyed with it. We do not apply any external heat to our friction scrubber, as Mr. Stedman does; neither do we empty the tar out of it. It is placed immediately at the end of the hydraulic main, in a separate room, and the gas enters it at 140°. We have found a very sensible relief from the deposit of naphthaline. We claim that we have a slight increase of candle power by the use of it.

The President—I will ask Mr. Stedman whether he considers his scrubber as simply a distillery for the tar.

Mr. Stedman—Yes; that is where we conceive that the greater benefit from it arises—in using it for that purpose. We used it some time before that without any apparent benefit except that it relieved the condensers of a great deal of duty. It took out a great deal of tar by friction while the gas was still quite warm. Afterward we put the hot coil of pipe in the bottom; the gas enters at the bottom, and as it enters it strikes right underneath the coil, on which the tar from the hydraulic main is dripping. Whatever beneficial results we have obtained have been mostly from the fact that this apparatus enabled us to distil the tar, or to release from the tar the light hydrocarbons that had been dragged down by the precipitation of the heavier carbons in the hydraulic main. That is the theory we have held for some time; and a good many experiments have been made in distilling the lighter oils from the tar, and in combining them with the gas as it passes off, after having left its heavy tar behind. There were some experiments made in that way with regard to placing a tank under the hydraulic main, so that the tar, as it came from the hydraulic main, ran into the tank, and was there heated by the coil of pipe that was in the tank; and the lighter oils were liberated in that way. I believe, however, that there were several mechanical difficulties in afterward getting rid of the tar from the tank. So much remained that it turned into pitch, and could not be readily removed; and so that plan was abandoned. In this case the tar does not form in there at all. It simply runs down through this coil, and, having passed over a certain amount of heated surface, while still hot it passes directly out, and no tar remains in the scrubber. It is constantly passing through, and fresh tar is as constantly taking its place. So that there is no difficulty about any pitch remaining there; and we have not had a single stoppage or occasion to open the scrubber since we used it in that way.

The President—There is a gentleman present who has had considerable experience with naphthaline, and is doing what Mr. Sherman does, but in a different form. He has a distillery in which he distils his benzole, and gets rid of the naphthaline in that way.

Mr. McElroy—I suppose that the President refers to me. I had in use the same scrubber that Mr. Stedman speaks of, but the tar from the hydraulic main did not pass through it. We found that the gas was being impoverished by being brought in contact with the heavier tars and pitch, instead of with the lighter tars. We have therefore thrown that scrubber out of the works this season. This is the dry scrubber that has been spoken of. They have been improved by putting the coil in at the bottom; and I have no doubt the plan is very effective if it passes the tar through. But we were passing no tar through, so that there was not much tar scrubbing there. I constructed a box $4 \times 3 \times 4$ feet, through which I pass all the tar made in the works. I accumulate it in a receiving well, separate it from the water, and pass the pure tar through this box, and on its way to the tar box subject it to 220° of heat by means of a steam coil. The vapors arising from that I condense in a lead coil in a barrel of water; and it is delivered into another barrel which stands below that, and the benzole is separated by gravity. They distil over about half and half; that is, there is about as much water as there is benzole in the vapors. I then passed the benzole into another still; but I found that that plan was not quite as good as what I am now doing. I now put it into a seal of water, and let the gas bubble through it. I let the gas bubble through the benzole as it is made, and before it goes through the purifier. This benzole carries over a large proportion of sulphur. I found the gas was a little impure, and showed a little sulphur under the former process; but now, after washing, it shows none. I eliminate the sulphur after passing through the benzole. I tried that plan last week. In one night I had 180 calls about the street lamps. The next night, if I had not adopted a new plan, I would have had 300 or 400 calls. But I conquered the difficulty this time. It all depends upon whether I have benzole enough. I have tried benzine and petroleum, but they have not the same effect. I find that 20 parts of benzine is only equal to one part of benzole. I have had naphthaline form in the hot pipes and in the cold pipes. Wherever there is a sudden condensation or a sudden

heat, naphthaline will be deposited. A brass fitting will catch it quicker than any other part of the pipe.

Mr. Ludlam—I am informed that a gentleman in Memphis has discovered a remedy for this difficulty. They have there been for years excessively annoyed with the naphthaline. He conceived the idea of mixing in his purifier one-third sawdust with two-thirds lime; and from that day to this he has never discovered a vestage of naphthaline. That was done several years ago. That plan is more simple than any of these other processes.

Mr. McElroy—The same gentleman recommended it to me, and I tried it immediately after going home; and I had calls right away.

Mr. Ludlam—I only repeat what I have heard. The engineer is here, and can give us further information.

The President—If the gentleman from Memphis is here, perhaps he will explain.

Mr. Prichitt—The facts are precisely as Mr. Ludlam has stated them.

Mr. Ludlam—It would be interesting to know what chemical change took place in the gas.

Mr. Butterworth—I would like to ask Mr. Ludlam one question. Is he troubled with naphthaline?

Mr. Ludlam—Yes.

Mr. Butterworth—Why don't you use the sawdust plan?

Mr. Ludlam—Because it is only five minutes since I heard of that plan.

The President—It is now nearly half-past five. I would suggest, as this is a very important subject for consideration, that it will be better now to adjourn and take this discussion up again in the morning just where we now leave it.

I am happy to announce that Mr. George Shepard Page will address us in this hall this evening on the subject of coal tar and ammonia.

The Association then took a recess until 7:30 P.M.

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EVENING SESSION—OCT. 19.

The Association met at 8 P.M.

The President—We have with us to-night Mr. George Shepard Page, of New York, who has given great attention to the subject of coal tar and its products. Mr. Page is an enthusiast upon this subject; he is an enthusiast with regard to the beautiful colors that may be obtained from coal tar; and he will tell us all about it to-night. I now have the pleasure of introducing him.

Mr. Page then delivered the following lecture upon the subject of

RESIDUAL PRODUCTS.

Mr. President, Ladies and Gentleman:—I wish that I might fully comply with the promise that has been made by our honored President, but it would be impossible to do so. Even if he had awarded me ten nights, or twenty nights, or even the remaining nights of the expiring year, it would be impossible to tell what has been accomplished since 1856 in this wonderful industry. I would take far more time than is allowed to me to speak of the wonders which have been accomplished since then in taking from this substance, coal tar—which is so very black, and has been exceedingly troublesome and valueless in years past, as connected with gas making—the results which have been produced by the chemists on the other side, aided as they have been, in a remarkable degree, by the dyers and printers of cotton, woolen, and silk goods in our own land, and some of which results are illustrated by the fabrics which are before you.

Without going over too much of the matter presented at Chicago a year ago, and thanking the Association for the honor of presenting this subject to you for the third time, I will first refer, somewnat in detail, to the general matters, and then speak at greater length of some of the later results, which are equally remarkable and wonderful with that first one, attained in 1856, by Mr. W. H. Perkin, then about 18 years old, who first discovered the mauve color.

Perhaps some of the ladies present, although closely related as the wives, daughters, or sisters of gas engineers or presidents, may never have visited the gas works. I have heard of such cases; and it is a sad neglect on their part, for I assure them that one of the most interesting processes that is being carried on in the world to-day is that of producing the light which, as all who were at Chicago will bear me witness, is far more beautiful than the elelectric light with which, a year ago, we were alternately dazzled and dimmed at the Grand Pacific Hotel.

Here is the substance which is known as coal tar. It is produced by high heat in the retort. These chemical results are due to the one fact that, in heating coal in a retort and gradually increasing the heat until it reaches 2000° or more, this coal tar is formed; and in that creation only is made possible the beautiful results. If coal is distilled at a low temperature, as it is in some parts of the country at the present time for obtaining petroleum and illuminating oils, then none of these colors are obtained. None of them can be obtained from the petroleum of Virginia, Ohio, or Pennsylvania, notwithstanding it has been asserted that they could be thus obtained. A distinguished Swiss chemist has been working in your own city, Mr. President, whose invention had been heralded across the water, and who came here with the assertion that now all these colors could be obtained from petroleum, in far greater quantity and at a much lower cost than that at which some of them now sell—namely, five, ten, or twelve dollars per pound.

Here is a specimen of the first color discovered by Mr. Perkin, which he kindly gave me last March. This (the magenta), when first put upon the market, because of its brilliancy and beauty, standing out as no color ever did before, sold at $323 per pound—being worth its weight in gold. If these colors could be obtained from petroleum, they would be worth only 25 or 50 cents per pound.

My friend Dr. Morton, some four or five years ago, made a thorough investigation into the petroleum series, endeavoring to discover a way by which these colors could be reached. He carried his investigations to the farthest extent; and to-day, as he did at the close of his investigation, he says they cannot be produced from petroleum. Hence there need be no fear in the mind of anyone associated with gas making that there will not be in the future, in aid of that industry, found in coal tar the cheapest and best source of the dyes of the world. Dr. Morton is my authority for the statement that at the present time probably one-half of the fabrics of the world are dyed by these products from coal tar, including silks, cottons, woolens, leather, wood, candies, the most beautiful of the wall papers, and even the pigments now used in wall decorations; and eventually, it is not too much too predict, every fabric will be dyed by these resultants from coal tar.

I will in a few words explain the process by which coal tar is obtained, and then refer to color making. As the gas reaches the water in the hydraulic main the coal tar is deposited slowly. More is extracted by the condenser; it ought to be *all* stopped at that point—none of it should go forward to the purifiers, but it often does. It should all be stopped before it reaches the scrubber or washer. If all were saved, there should be an average of not less than 15 gallons per ton of coal carbonized. English Gas companies obtain 12 gallons, which is equivalent to our 15, the imperial gallon being 20 per cent. greater. The coal tar is then put into a still, which is entirely closed except an outlet by a pipe 4 inches in diameter, by which the ascending vapor, set at liberty by the fire under the still, passes out. The pipe passes through a condenser containing water; the vapor condenses, and there is given off, first, a light oil—lighter than water; then an oil heavier than water, called creosote oil; then anthracene oil, which contains the substance anthracene, from which alizarine or artificial madder has been obtained; and there is a fourth product, which remains in the still as pitch. Usually, however, but three products are obtained—the light oil, the heavy oil, and the pitch. But two or three firms in the United States are making the anthracene oil or anthracene. There are also two or three concerns in this country which take the light oil and make from it benzole, naphtha, and toluol. From the benzole and toluol beautiful colors are obtainod.

Then we come to the heavy oil, the creosote oil, of a brownish hue, which posseases great value and interest, because the discovery was made, in 1838, that it was the only substance which would prevent wood from decaying. No matter where or how the wood was exposed, if it were protected by creosote it would not decay. Whether it be a railroad tie, a timber in a bridge, or a pile in the water, chemists say that if the pores of the wood are filled up by the naphthaline and other resinous matter in the oil, and if the albumen be coagulated by the action of the cresylic acid, there can be no decay in the wood. The use of creosote also prevents the ravages of that wonderful animal, the *teredo navalis*, or marine worm, one of the most singular animals known to scientists. Many vessels which have left port on a voyage from which they never returned, have been sunk in mid-ocean by this insignificant worm. He is at work where he cannot be reached. A sea captain said to me not long ago: "I never suffered so much mentally in my life as I did two thousand miles from land, lying in my berth and hearing, night after night, the incessant boring of the teredo. I knew not when the whole planking below the water line would become so honeycombed that the vessel would absorb water at every point and be carried down. We were helpless to prevent it."

Let me at this point describe this animal. Immediately on being hatched from the egg it floats about until it comes in contact with wood, and is then at once ready for work. It immediately begins boring. The point at which it enters the wood is almost invisible to the naked eye; they rapidly increase in size. There are many galleries made by them in this specimen of wood, which was exposed for two years at the Battery in New York. In boring they never cut through the channel made by another, but they curve about in all directions. You can see their mode of working in this piece of wood. This round, white, shelly substance has an opening at the top, from which protrudes what the naturalists call the "foot." It is more like

a hook. This is attached to the wood, and holds fast while the hard shell is moved to and fro. It combines in its structure a gouge, because it can gouge the wood; a file, which is wonderfully efficient; and an augur for boring (a Yankee in Holyoke, Mass., copied the teredo's implement and took out a patent on it). The microscope reveals the fact that there are on this wonderful tool 20,500 cutting surfaces. As the teredo enters and penetrates the wood it grows in size. I have here a piece of wood which was exposed for two seasons in the Gulf of Mexico. During that time this animal I exhibit grew to the length of 22 inches. The teredo would suffer speedily but for an exceedingly ingenious appliance which he has at the outer end. It is a little apparatus shaped like a file, which protrudes from the aperture by which he entered. If the young barnacle, which also floats in the water, should strike the piling, attach itself over the opening, and inclose the teredo, the latter would die. He does not want to die, and therefore this projects and keeps an opening through which he gets his food. Many naturalists have supposed that the teredo fed on the wood. This is not the fact; he simply makes his house in the wood, and obtains his food from the water through a little apparatus situated between these two filing points. All the wood that he bores or files off is passed through the animal and out into the water.

An exceedingly valuable discovery was made when it was ascertained that by impregnating with creosote the wood intended for the planking of ships, for piling, or for bridges, the ravages of the teredo could be prevented. I have here an illustration of its use. This piece of wood is a section of timber; in the center a hole an inch in diameter was made, then an iron pipe 12 feet long was filled with the oil, and the pressure caused the oil to penetrate around the hole two inches. The timber was then put into the water. The teredo entered at many points, but not into the portion which had been impregnated with the oil. It says to the teredo, "Thus far shalt thou go, but no farther." The teredo encounters in the oil something that he does not like; it is poisonous to him, and he retreats. As illustrating the utility of creosote as a preventive of the ravages of the teredo, I may state that the Mobile and New Orleans Railroad Company have nearly seven miles of bridges between New Orleans and Mobile, and the piling supporting these bridges was cut off every year by the teredo; so that not only did they pay no dividends on the stock, but the teredo almost destroyed the value of the bonds, of the road. Now every piling and bridge timber is creosoted, and the road is beginning to pay again. The Government is now using creosote very largely in the timber used in the harbor improvements at the mouth of the Raritan, and at several other points. Works are being erected by railroad companies and private parties.

I speak of this as having an important bearing upon the value of coal tar. In England creosote oil is used very extensively for wood preservation, it is also used largely on the Continent for the same purpose. A demand exists for all the creosote oil which can be produced from all the coal tar in the United States. If this were separated from the coal tar it would realize the sum of $350,000 per annum. The gas companies receive only $200,000 for their coal tar. Coal tar is largely used for paving and roofing in the crude state, and also burned in the retorts. The increase of such an important industry as the preservation of wood, by the use of a residual product, is a matter of vast importance to the gas fraternity.

I have said that very few in this country were producing the oil called anthracene. The little sample which I have here is the first that I ever saw of it. It was made in 1869, and was given to me in Glasgow in January, 1870—it then being worth $100 per ton. The gentleman who presented it to me said, "Mr. Page, in five years, anthracene will be worth $2,000 per ton!" In two years it was worth $2500 per ton!

Its bearing upon the question of the use of coal tar in our country is this. During the time that this substance has been used for producing alizarine, or artificial madder (the Turkey-red which you see in these prints before you), there would have been gained in actual receipts from the other side of the water, a large portion of which ought to have been gathered by the gas companies, a sum of not less than $500,000 per year. I know that the gas companies of the United States have not received one-half that amount during those years for all their coal tar; and anthracene forms but one-half per cent of the coal tar! Therefore, by the lack of knowledge, and by the lack of preparation, an amount of money averaging half a million of dollars per year, during the past eleven years, has been lost by the gas industry. I use that illustration to call attention to this point—that, in these discoveries, some of which have taken place recently, if those who are producing the coal tar are in a position to avail themselves of the demand for the special product, at the time when the highest price obtains, then the fair share of profit will be gained by the gas companies. Let me illustrate that still further. The first discovery in colors, as I have said, was made by Perkin, in 1856. Following that, was a long series of discoveries and manufacture of dyes, termed the aniline dyes, which are mainly obtained from the light oils. When I show you this book, in which is printed a catalogue of one of the German manufacturers of aniline dyes, giving, line after line, the name of the dyes, embracing all shades from the most beautiful crimson to the most exquisite shades of green and blue—256 distinct colors manufactured by this one house, and the prices ranging from $1.25 to $15.00 per pound—it will indicate to you what has been done since Perkin made his first discovery.

Next in importance was the discovery of artificial madder. It will be of interest at this point to present a part of the history of alizarine, or at least some prominent facts which will seem to demonstrate conclusively that to the original discoverer of the first coal tar dye is also due the credit of presenting to the world commercially the equally valuable new chemical product alizarine.

The German chemists Graebe and Liebermann have been awarded this honor; but the weight of evidence certainly goes to prove that the laurel crown must be presented to the distinguished W. H. Perkin.

Anthracene ($C_{14}H_{10}$) was first separated from coal tar by the French chemists Dumas and Laurent in 1832. In 1854, when Mr. Perkin was but sixteen years of age and studying under the famous chemist, Dr. Hofman, then of London and now of the University of Berlin, he was given anthracene for his first investigation and separated it from soft coal tar pitch. A year later great mortality occurred in South America, among the Peruvian bark trees, from whence is obtained quinine. The physicians of London requested Dr. Hofman to attempt to make quinine artificially. He directed Perkin to search for it in coal tar, and from that Providential incident arose Perkin's discovery of the first aniline dye, and, in connection with his brother, the commencement of its manufacture.

Not until the latter part of 1868, or early in 1869, did Mr. Perkin begin seriously to attempt to discover the process of converting anthracene into alizarine. He was not very long in attaining the result, and demonstrated the feasibility of manufacturing this coloring matter in large quantities at a price which would compete with madder. In May, 1869, he forwarded to Mr. Robert Hogg, of Glasgow, patterns dyed with artificial alizarine. It is true that Graebe and Liebermann had produced a minute quantity of alizarine by the use of bromine; but the cost on the commercial scale of manufacturing would be very much greater than the natural madder dye. Hence their discovery was not of the slightest value to the world; it was simply a laboratory experiment. Perkin patented his invention in England, and holds the prior right there to-day. Graebe and Lieberman applied for a patent in Germany and were refused. They immediately made application for a patent in the United States, as did Perkin, who was, unfortunately, one day behind the Germans and lost it. Graebe and Lieberman and their assignees, the Badische Anilin and Soda Fabrik, of Mannheim, will realize from that American patent not less than $30,000,000 profit.

A further demonstration of the fact that Perkin is entitled to the honor of having made this a commercial success is given by Graebe and Lieberman themselves, who published in the *Moniteur Scientifique*, in April, 1879, a tabulated statement of the production of alizarine under their process:

1871, 125 tons; 1872, 400 tons; 1873, 900 tons.

Mr. Perkin's production dates from two years earlier:

1869, 1 ton; 1870, 40 tons; 1871, 220 tons; 1872, 300 tons; 1873, 425 tons.

There can be no question, therefore, that the birth-place of the manufacture of artificial alizarine was in England.

Now let us glance for a moment at the wonderfully rapid growth of this industry. In 1878, 9,500 tons of alizarine were produced, of the value of $7,500,000. This remarkable result was arrived at in ten years. The cultivation of the natural madder is now a thing of the past. One of the most interesting specimens I have in my exhibit is a sample of madder root grown by Mr. Perkin on his estate at Harrow, England, and received from his hand, while his guest a few months since.

It will be of interest to know the statistics of the coal tar color industry in 1878:

| | |
|---|---|
| Germany (of which 4-5ths were exported) | $10,000,000 |
| England | 2,250,000 |
| France | 1,750,000 |
| Switzerland | 1,750,000 |
| | $15,750,000 |

The estimated value of the production of coal tar products in 1881 is nearly $25,000,000; and the United States hardly appears in the inventory.

Chemists have known that coal tar contains the constituent parts of indigo—the fast blue color which has been known for certainly more than 2,000 years. Pliny speaks of it when he says to someone going to the far East: "Bring back, if you can, a sample of that wonderful dye which never fades, called indicum." It came from the East. You who have Turkey rugs at home see in the blues the fast color remaining there, and the reds are also permanent; but the other colors are more or less evanescent. Therefore many chemists have been endeavoring to make artificial indigo. The announcement was made at the close of last year that it also had been

made from coal tar. I brought back with me, and now show you, probably the first and only sample of indigo in the United States produced in that way.

Madder cultivation employed thousands and tens of thousands of agriculturists in France, Holland, Spain, Turkey, and Russia. Ten years put an end to that industry, and undoubtedly the same term will serve to displace indigo growing in India, Africa, Ceylon, and South America. I have received from one of the importers of indigo a statement as to the amount brought to this countay—not less than $3,500,000 worth per annum. This can be made of value to the coal tar industry of our country, if there can be brought about what is essential—the location of the manufacture here. This cannot be until the fine products, the bases of these colors, are manufactured here. By the present use of coal tar they are wasted. The proper and only way of making it available for obtaining these valuable products is to aggregate in large quantity, at a common center, the coal tar from the different gas works, and then, by the aid of skilled chemists, these substances, possessing such great value, the bases of the dyes, can be sold by the companies, and thus secure and retain a part of this aggregation of wealth that has been created since Perkin made the first discovery. It now passes into other hands.

While on the other side I visited the great works at Beckton established by the Chartered Gas Light Company, who, as many of you know, are working their own residuals; and those of you who have read their reports in the *Journal of Gas Lighting* can plainly see what has been gained. At the present time there are many gas companies in England who, from the coke, ammoniacal liquor, and coal tar, derive nearly 70 per cent. of the value of their coal. With these new products that are being obtained, we may expect soon to realize what the late Dr. Letheby said would be the result in the future, although he might not live to see it, when "gas would be the residual product." Had his life been spared to the age of many whom I see before me, Dr. Letheby would have witnessed the fulfillment of his prophecy. That time will come in the near future, and for the United States; because inventive talent here is riper and more active than on the other side.

I must, before concluding, call your attention to the beautiful goods and fabrics which are before you. They are all of American manufacture and American dyeing. It has been said by parties on the other side that the work of American dyers is equalling, if not surpassing, that accomplished by the dyers of France, England, and Germany. I was to-day in conversation with a gentleman who is the treasurer of one great print works in this section. He showed me sample after sample of goods. He said: "These goods are going to Spain; these to Cuba; and these to South America. The reds of these prints contain the artificial madder, and the blues the aniline—all of which is imported." The print manufacturer in this country is obliged to pay for alizarine just five times what his competitor in England is paying; that is, $1.20 for 20 per cent. alizarine, which would be $6 per pound, while his competitor in England and Germany is paying but 20 cents per pound; yet the machinery and the trained skill of America is overcoming that great difference in the cost of the fabric, and is putting these prints into foreign markets at a price of not over 6½ cts. per yard. They are sent to Spain, to Cuba, to South America, and to China; and the Chinaman finds that they are not weighted with 20 or 30 per cent. of starch. He says: "It muchee washee; it standee wellee; it lastee me. And so the trade is coming back to us which, during the war, we lost across the water. The time cannot be far distant when even these other goods which you see here—the black being the aniline black from coal tar; the Turkey red from the artificial madder. the blues from the aniline—will also be sent abroad. Speedily all of these colors will be manufactured in this country. The way for it is now opening.

Let me call your attention to these other goods, also American. Here is something which is *not* American, and at the conclusion of my address I want you to examine this, because it is certainly the most beautiful combined effect from coal tar dyes that I have ever seen. It was printed at Mulhause, the center of the printing industry in France, on cotton, in 18 different colors, resulting in something that is nearly as exquisite as the famous Gobelin tapestries. And this other you will be interested in, knowing it is the first product of an American printer at Malden, Mass., but five miles from this hall, who is imitating, and, judging from this, his first result, will soon surpass that wonderful French production. I wish also to call your attention to this frame. It is also from Mulhause. Examine it as closely as you please, for it is one of the most exquisite results of art industry.

There are some other uses of the coal tar products. Never a newspaper is printed in this country, or in England, or anywhere in the world, except by the use of an ink which is indebted to coal tar for its chief constituents. The lampblack, made from creosote oil, is united either with resin oil or linseed oil, and produces printing ink. The book and the newspaper is dependent every day and every hour upon this industry. Even the electric light is dependent upon it, because the carbons which are being produced and used so extensively are largely indebted to that which is left after everything else is taken from coal tar—coal tar pitch. Coke is 90 per cent. carbon. Had the lamented professor of Harvard lived 20 years longer than this A.D. 1881, he would perhaps have seen realized what he prophesied when, in the *Annual of Science*, published at Harvard in 1857, he said:

"A chemist in England, W. H. Perkin, has succeeded in producing from coal, in ten processes, coal, coal tar, crude coal tar oil, refined coal tar oil, benzole, nitro-benzole, crude aniline, aniline oil, aniline, and mauve—a substance worth its weight in gold. The diamond is to come."

And when will it come? We shall have a substance almost as valuable as the diamond when chemists succeed, as I believe they will, in obtaining from coal tar that medicinal remedy which doubtless all of us take during some portion of our lives, and which in these later years many of us are taking very freely—quinine. It is now being used the world over. Its value is $3 per ounce, even when bought in quantity. When bought, as I was obliged to buy it this year for the first time, in the pill, how much does it cost? Almost as much as the diamond. Quinine from coal tar is not far distant. Many able chemists on both sides of the Atlantic are seeking to find quinine. Dr. Morton, Dr. Chandler, Dr. Barker, of the University of Pennsylvania; Prof. Johnson, of the Scientific School at Yale; Prof. Gibbs, of Harvard—all say that it will come at no very distant day. Coming as it must from some one of the products of coal tar, it must add great value to this residual.

The lesson to be learned by us from these facts is this—instead of parting with the coal tar as you now do, some by burning, some by selling it for concrete pavements, or for producing pitch for roofing, push forward the industry which I have suggested. Let the coal tar produced by many companies be aggregated. Let skilled chemists be employed. Then, when the article is wanted that produces quinine, they will send to you for it. When Germany wants the article from which to produce the indigo, as she will by-and-by, she will send to you for it. Other countries will then send to this country for the supply of anthracene. Then the gas companies can share in the profits derived from the sale of these residuals, and not be obliged, as now, to content themselves with an average of twenty cents per ton of coal carbonized.

I referred last year to the fact that at Rondout there was an industry engaged in the manufacture of fuel by using ten per cent. of pitch with ninety per cent. of anthracite coal dust. Thus this waste, with the addition of coal tar pitch, results in making something of equal or greater value than the coal as it is mined in Eastern Pennsylvania as anthracite, or in Western Pennsylvania as bituminous. In the anthracite coal fields alone this coal dust is wasted and accumulated to the extent of five millions tons per annum. I am informed that there is also, in Philadelphia, an establishment in successful operation for the manufacture of stove coal for house consumption. At Port Richmond—which is the tide-water port of the Philadelphia and Reading Railroad—there has been for years an accumulation of 100,000 tons of waste coal dust per year, from the handling of 3,000,000 tons of coal per annum. The industry has also been established there of making, from pitch and coal dust, a fuel which is suitable for use in stoves. Therefore, if this industry, which for twenty-five years has been employed on the other side to the extent of producing last year five million tons of artificial fuel, using all the pitch produced from every ton of coal carbonized for that purpose, can be here brought into equally successful operation, there can be no question as to the demand for that product of the coal tar in the United States.

Another residual, well-known to many of you, and to all undoubtedly, is this medicinal agent—carbolic acid. It is in use by every physician. It is used in various medical compounds, reaching the world over. Indeed, a cablegram from Japan to New York, not long ago, called for twenty thousand pounds of carbolic acid to be used during the cholera season there. This substance is produced solely from coal tar. It cannot be obtained from petroleum, nor from any other source. The demand for it is as stable as for quinine.

Another substance obtained from coal tar is the oil of myrbane, or nitro-benzole. Here is a specimen. In it you can detect the odor of almonds. The almond odor which you notice in soaps is obtained from coal tar. This is not the artificial oil of bitter almonds. That is another product of coal tar, and is used in cake, candy, pomades, etc., in place of the true oil of bitter almonds. It is a singular fact that the only difference between the artificial oil obtained from the coal tar, and that obtained from the bitter almonds, is that the oil obtained from the latter contains seven per cent. of prussic acid, while that obtained from the coal tar contains but one per cent.; so that if there be any question as to the poisonous quality, it is found in greater degree with the substance from which the almond oil has been heretofore obtained.

From coal tar there is also being produced, in quite large quantities, th

oil of wintergreen, which is a favorite flavoring and perfume. It would seem as though the end was never to be reached in the discoveries to be made. Something new is constantly being found in it. So new in this country is the chemical development of coal tar products that we are still as it were in the "A.B.C." But I am sure that, with what is being done at the Boston Institute of Technology, at Harvard, at Yale, by the famous Dr. Morton at the Stevens Institute of Technology, at the Pennsylvania University in Philadelphia, and the distinguished Dr. Chandler at the School of Mines, Columbia College, there are now coming to the front scores of earnest students ready to aid in establishing every branch of this vast industry; while other bright young men are obtaining a practical knowledge of the subject by going across the water and finding employment in the aniline and alizarine works on the other side, working as day laborers, in order that they may bring back to America the information as to the practical details of the art which they will thus acquire.

If at the present day the manufacturers of aniline dyes in Germany, France, Switzerland, Belgium and England are paying the prices which they are for anthracene, benzole, toluol, etc., gathering them up wherever they can, even in small quantities, there need be no fear about the continued demand and handsome margin of profit in this country.

I do not know that I ought to detain you further; but, in concluding, you will pardon me if I exhibit to you a likeness issued before the lamented death of our late President. All of you who have looked upon that face in the many prints, photographs and engravings, and especially those who have seen that face, as I have, in Washington and in his own home, will recognize this portrait. All of the colors, and especially the dark background which brings out in clear relief the magnificent forehead—all of the dyes here, the aniline and the alizarine—are from coal tar. Thousands and tens of thousands of these pictures were scattered to and fro through the land.

I have many specimens of prints from Lowell that may be of interest to you, and which you will please inspect. In nearly all of them you will find fast colors from coal tar.

In conclusion, permit me to call your special attention to the magnificent display of silks, satins, woolens, cottons, hosiery, prints and other fabrics, kindly loaned for this occasion by the well-known firm of Messrs. Jordan, Marsh & Co., and to bespeak for them a unanimous vote of thanks.

The Association then adjourned until Oct. 20, at 10 A.M.

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### Second Day—Morning Session—Oct. 20.

The Association met pursuant to adjournment.

#### SUPPLEMENTAL REPORT OF THE EXECUTIVE COMMITTEE.

The Secretary—Several matters were referred to the Executive Committee First—a proposition that the bye-laws be changed so as to make the office of President elective annually. The bye-laws already provide for that. The intention of the recommendation, however, was this: that no President shall hold office continuously for more than one year. This matter was considered in the committee, and they decided that it would be better to let it stand as it is, with the understanding that, as a general rule, the President should hold his office by election only two years. They think that sometimes, if we should elect an officer for but one year, it might be considered as a slur upon him in failing to re-elect him; and, perhaps, it might sometimes be proper to elect a President for three years. They, therefore, do not recommend any change in that respect.

Also—that the offices of Secretary and Treasurer be separated, and that they be elected annually. They recommend that no change be made in that provision, because they do not think it would be convenient for the offices to be separated. The two officers might be in different parts of the country, and there might be a difficulty in collecting dues, and in keeping informed as to membership, without considerable correspondence between the two officers. They, therefore, recommend that no change be made.

Mr. Greenough—I move that the report be laid upon the table for the present. I must say that I do not agree with the report of the Executive Committee, and I shall move a resolution contrary to that report. I think that the Nominating Committee unanimously agreed yesterday that there were many reasons for making the office of President elective for only one year. The gentleman who has just taken his seat suggests that a failure to re-elect him might be considered a reflection upon the President. It is exactly for that reason that I think we should adopt a rule declaring that no person shall hold the office longer than one year at a time. In that case he could not feel that any reflection was intended for himself if he were not re-elected. A gentleman holding office for only one year, of course, puts a great deal of time into the preparation of his address, and feels himself called upon to review the events of the year at greater length than he would if he were called upon to perform the same duty for several years in succession. If the bye-law is altered so that he cannot be re-elected he can then have no feeling in the matter. I trust that the report of the Committee will not be passed upon too hurriedly. I move that this matter be laid upon the table for the present.

Mr. Denniston—I second that motion; and I wish to say that with regard to the Committee who made the recommendation that it was unanimous. If you make it compulsory that there shall be a change of officers each year there can be no feeling in the matter. As it is now, as the Committee on Nominations found, it is largely a matter of feeling—that is, if the present officers desire a re-election they do not like to assume the responsibility of changing. Now, if you make it mandatory, and provide that the change shall be made, and that the President shall not be eligible to a re-election, then the change must be made by that committee. They will have no choice in the matter. It will not then be a matter of feeling simply, but a choice of the members. In an Association as large as this, and with the intelligence that there is in this body, it seems improper that there should be such a continuation of officers. I advocated this change, in the first place, as chairman of the Executive Committee, and recommended that they begin at the top to make these changes, which put my official head first in the bssket. I think that is the better plan. I do not know, however, that this is the time to talk about this matter. Under the Constitution this should lie over until the next year, and then come up, in the report of the Executive Committee, for action by the Association; and I may say that it is not necessary that the report of the Executive Committee be laid over, because it becomes compulsory, under the laws, for the Executive Committee to make some report at the next meeting upon any recommendation made by five members of the Association. The Executive Committee, being composed of five members, can make this recommendation. This Committee have acted unofficially in making it, because, when the officers were nominated, and their report made, that ended their duty, so far as a committee was concerned. However, in their judgment, they thought best to make this recommendation; and I think it will come up regularly next year in the report of the Executive Committee, and be discussed then.

Mr. Greenough—It is, as has been said, impossible for us to take any action in the matter with regard to the change until next year; but it is possible for us to take the sense of the meeting on the subject by the passage of a resolution. I move that it is the sense of this meeting that the President be elected annually, to hold office for one year.

Mr. Harbison—I second that motion.

The President—If Mr. Neal will excuse me, I will correct an impression which he did not intend to make in making his report. A gentleman suggested that the report should be changed, recommending that the President be elected for two years, and be eligible for office for but two years; and I said in reply that I did not think that would be the most satisfactory arrangement, as it might hamper the Association somewhat in case they did not desire to re-elect a President, and it might annoy gentlemen who were not acceptable in the office if they were dropped.

Mr. Armington—I desire to say something on this subject. The Nominating Committee lost their lunch and held quite a lengthy session in determining upon the nominations and recommendations. Although we hear our statesmen say that there is now no north and no south, we found that as to this Association there was most decidedly not only a north and a south, but an east and a west. We could see no way out of this difficulty but to bring the matter before the Association in the way we have done. I think that this Association will be very much better governed, and there will be fewer jealousies and less local pride felt in having "our man" selected, if this thing is followed up. It will give all these different sections of the country a chance to have their man in office if they choose to put him there. I think that the adoption of this recommendation of the Nominating Committee will do away with a great deal of hard feeling.

Mr. Stiness—I would like to say that if this report from the Executive Committee should be recommitted to them, with a request that they make a report at this meeting upon the recommendations which were made yesterday by the Nominating Committee, we may be able to act upon it; but if it lies upon the table, or goes to the Executive Committee without some such instruction, it may be pigeon-holed or not considered until the next annual meeting, and then perhaps the matter may be postponed until another year. It seems to me that if this report were recommitted to the Executive Committee, with a request that they report on the recommendations as made by the Nominating Committee yesterday, it could then be acted upon and disposed of in a very few minutes.

Mr. Harbison—The same point which was raised yesterday comes up now quite forcibly—that it would be contrary to the Constitution. The Executive Committee cannot properly report, nor the Association consider, anything amending the Constitution, except at the next general meeting held after that at which the change shall have been proposed, so that we cannot act upon this matter at this session; it must go over until next year.

Mr. Stiness—I would suggest that they simply bring it in as their report; and then it can lie over until the next year, and then be acted upon.

Mr. Harbison—That will do.

Mr. Butterworth—I think that was the intention of the Committee. They simply desired to put it into that shape. It complies with the Constitution in that respect. We did expect that the Executive Committee would take cognizance of that fact, and bring in a such a report that the matter would come before the Association next year and then be voted upon according to our Constitution. As Mr. Armington says, we had not only a north, a south, an east and a west, but also a part of Canada upon that Committee; and we all had friends whom we wanted to have represented. Some of us had friends whom we could not get on under the present state of affairs; and we, therefore, agreed that this recommendation, with reference to holding office for only one year, was a judicious one, and we would like to have it come before the meeting in regular shape so that we can take a vote upon it a year from now.

Mr. Greenough—I think that probably the best way out of this matter is for me to withdraw the motion which I previously made, and to offer, instead, a motion that this matter be recommitted to the Executive Committee with instructions to bring in such an amendment to the Constitution next year as will prevent the holding of office by the President for more than one year.

The Secretary—Allow me to suggest that they should bring it in now, in order to have it in such shape as that it can be acted upon next year. Will you modify your motion that it be recommitted, and that they report this afternoon such recommendation as they desire made; and then it will be ready for action next year.

Mr. Greenough—I will so modify my motion.

Mr. Armington—I think that it should be so modified; and it is essential that it should be done at this meeting that it may be acted upon at the next. I think it would be well to have an expression of the sentiment of the meeting upon the subject, in order that the report of the Executive Committee may properly represent that sentiment. I think, therefore, that the motion ought to be put—that it is the sense of this meeting that that office ought to be held for but one year.

The President—That ought to come in the form of an independent resolution.

Mr. Denniston—I do not exactly agree with my friend Armington about that. This will have to come up for discussion when the Executive Committee report next year, and be then acted upon; and any action that we might now take would not be binding upon the Association next year. I do not think that any motion is now necessary. It is not expected that the Executive Committee will report now; inasmuch as it can be talked about and come up for discussion when the Executive Committee report at the next meeting, before the election of officers. If the report be then adopted it will, of course, bind the Association.

The President—The first motion is to recommit this report. I understand the question to be upon the recommitment of this report to the Committee which reported it, in order that they may make such alteration as they think expedient, and report this afternoon or to-morrow morning.

Mr. Greenough—My motion is to recommit that whole subject to the Executive Committee, with instructions to report next year an amendment to the Constitution such as we recommended. We made the recommendation yesterday and it was referred to them. They have reported back adversely to our recommendation. We now wish to instruct that Committee to report in favor of our recommendation, and to take the sense of the meeting upon it.

The President—I understand the motion to be that this report be recommitted to the Executive Committee, with instructions to report next year an amendment making the President eligible for office for but one year.

Mr. Littlehales—I suppose that it is understood that a gentleman having once held the position of President would not thereafter be forever disqualified from holding it again?

The President—After a second year he can hold it again.

The motion was then agreed to.

### WEIGHTS AND MEASURES.

Mr. Slater—At the last meeting of the Association a committee was appointed to recommend something in relation to weights and measures; and in their report they recommend that the United States Standard bushel, of 2150.42 cubic inches, be adopted for the measurement of coke and lime. In making that recommendation it probably did not occur to the Committee that coke has been measured by the heap bushel, and that in a heap bushel there are 2748.7 cubic inches, instead of 2150.42. It occurs to me that in the paper I have brought here I have figured the heap bushel for the coke, which will not correspond with the recommendation of the Committee as to the standard bushel. It seems to me that it would be well to amend that by making the coke bushel 2747.7 cubic inches, as the coke it is generally thus sold.

The President—Do you move to amend the report adopted last year?

Mr. Slater—Yes; the report made last year at the Chicago meeting. I move that the standard measure, with reference to coke, be 2747.7 cubic inches.

Mr. Young—That is the standard for calculation; but I do not suppose that each company is compelled to sell its coke upon that basis.

The President—I suppose the object is to fix a standard bushel in our measurements of coke and lime, which shall be agreed upon as the standard in our papers and discussions; so that in all our statistical documents and reports we may have a clear idea of what is meant when a bushel is referred to.

Mr. Slater—That was the object in appointing the Committee.

The President—It does not, of course, bind anybody to sell coke according to that rule.

Mr. Slater—Not at all; the only object is to secure uniformity in our papers before the Association.

The President—I suppose the report which has been made settles the point as to what shall be considered a bushel in our papers, and that the object of Mr. Slater is to correct mistakes which have heretofore been made because of the diversity in the size of the bushel measure used for coke.

Mr. Slater—That is all that it has reference to. It does not compel any company to sell coke by this measure.

The President—It simply means that in our discussions and statistical papers a bushel of coke shall be understood as containing so many cubic inches.

Mr. Helme—I would like to inquire of Mr. Slater whether the associations in Europe have any fixed number of inches to the bushel; because we are very often called upon to compare results of operations here with results of operations there, and it seems to me to be very desirable, if they have a fixed number of cubic inches to the bushel, that we should adopt the same number.

Mr. Littlehales—I will say that the measure in use in England, the common measure, is a good deal of what we term "the rule of thumb;" but there are two measures in use—the imperial and what is known as the Winchester bushel. I cannot tell the exact proportions of each, but I think they vary about 8 per cent. in the number of inches. I forget the exact number of inches. The local customs of England with regard to measurements are totally different. For instance, a bag of potatoes in one place will contain 50 or 60 pounds more than it will in another place. In some places they sell coke by weight; and in some places they buy lime by weight. We buy our lime, nominally, by the bushel, but we buy by weight, estimating 75 pounds per bushel.

Mr. Helme—From Mr. Littlehales' explanation, I do not see that we have anything to gain in making a change in that direction; and I suggest that we adopt the motion made by Mr. Slater.

Mr. Breese—What has been understood heretofore as the standard bushel?

Mr. Slater—It is 2150.42 cubic inches now.

Mr. Breese—If there is a difference, we would like to know what the difference is.

Mr. Slater—Perhaps the gentleman will understand it better if I read the report of the Committee:

"Your Committee, to whom was referred the matter of a standard for weights and measures to be used exclusively by the members of this Association in comparison of results, beg leave to make the following recommendations:

"1. That all statements of gas production be made in cubic feet per pound of coal, specifying the kind and quality of enriching material used—if it be cannel, in percentage of the total weight; and if naphtha, in gallons per 1,000 cubic feet of total gas production.

"2. The United States standard bushel, of 2150.42 cubic inches, for the measurement of coke and lime. Statements of lime to specify whether slaked or unslaked.

"3. The United States standard gallon, of 231 cubic inches, for the measurement of tar, naphtha, oil, and ammoniacal liquor.

"4. That all statemetts of illuminating power be accompanied by the description of the burner and photometer used in testing. And we further recommend the general adoption of Sugg's London D burner."

The report of the Committee was adopted as I have read it. It is all right enough, perhaps, with the exception of its application to coke. I think that in this country it is generally the case that the United States standard heaped bushel is used. The standard struck bushel is 2150.42 cubic inches. As we use the heaped bushel for coke, it seems to me better to adopt the number of cubic inches in the heaped bushel, which is 2747.7. That is the motion which I make.

The motion was agreed to.

[To be continued.]

## Roport on New York Water Supply.

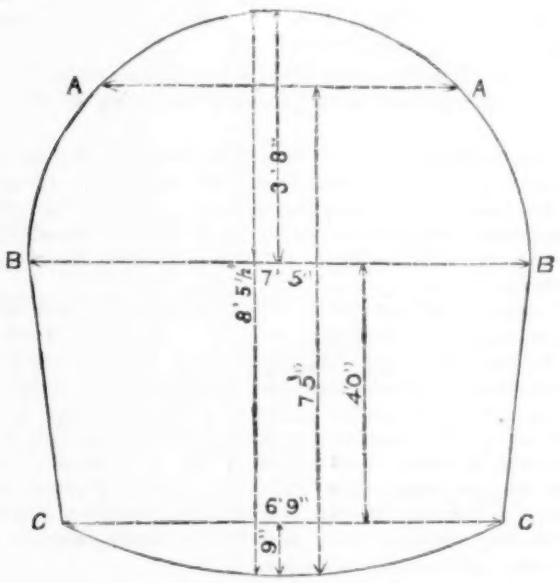
By Isaac Newton, C.E., Chief Engineer, with Opinion of E. S. Chesbrough, C.E., Consulting Engineer.

Department of Public Works,
Chief Engineer's Office,
New York, April 11th, 1881.

*Hon. Hubert O. Thompson, Commissioner of Public Works:*

Sir—In accordance with your instructions I beg leave to present the following statement on the water supply of this city:

The Croton aqueduct, which conveys the entire supply, is of masonry, the bottom being an inverted arch with a chord of six feet nine inches and a curvature of nine inches from the horizontal; the side walls extend four feet above the chord line of the bottom arch, with a batter of one inch to one foot—epual to four inches on each side—making the interior width at the top line of the side walls, which form the abutments of the roof arch, seven feet five inches. The roof is a semi-circle of three feet eight and one-half inches radius. The following outline cross-section of the interior of the aqueduct will make clear this description as well as other points which will be spoken of.




Scale 3-8 Inch=1 Foot.

**AA, Average present water level.**
**BB, Spring line of roof arch.**
**CC, Chord of bottom arch.**

Its entire cross-sectional area is 53.34 square feet; up to the line of average level, AA, at which the water is carried, it is 49.55 square feet. The original report of this work indicates that the maximum depth of water intended to be carried was 4 feet 9 inches above the bottom. The designer and constructor of the work is reported to have "estimated the full capacity of the conduit at 60 million gallons per day, and assuming, on the experience of other large cities with similar appliances for furnishing water, that 30 gallons per day for each inhabitant would be ample supply, this would suffice for a population of two millions. To deliver this quantity of water the aqueduct need only be filled to the spring line of the arch; a glance at the sketch showing a cross-section of the masonry conduit will show that above that line the power to resist pressure from the inside is greatly diminished." Subsequent experience with this city as well as with all others which supply water under a constant head in the United States has shown that this rate of supply is far from being sufficient to meet the imperative demands of increase of manufactures and other unavoidable necessities requiring the use of water.

The utmost capacity of the aqueduct has been variously stated, in different reports, at 90 to 115 millions gallons daily. There is not sufficient data at hand to enable me to state the amount with absolute accuracy, but measurements and calculations recently made show that during the year 1880 the average daily delivery was at least 12,700,000 cubic feet, or 95 millions of U.S. gallons. It is not at all probable that the investigation now in progress will increase this estimated capacity more than two or three millions. For the present the maximum safe capacity will therefore be taken at 95 millions per day, and the records of the Department show that this rate has been maintained for about seven years. At one time when the flow as estimated was forced to upwards of 103 millions, the consequences were disastrous, for this rate caused serious damage to the aqueduct, and it was therefore reduced. To discharge the 95 millions gallons requires that the depth of water in the aqueduct where it is on solid ground be maintained at about 7 feet 5 inches, that is 12½ inches below the highest point of the roof; where the aqueduct is on embankments and has settled, the above depth brings the water in contact with the roof, so that in those localities the entire section is under pressure from within.

It will therefore be seen that the aqueduct is now, and has been for many years, delivering water to its utmost safe capacity. When the aqueduct is entirely filled, but not under additional pressure, it conveys less water than when a little space is left at top—to subject the aqueduct to additional pressure would be incurring a fearful and unjustifiable risk, and was never intended in the original plan. From the time the maximum discharge was first reached to the present, the population of the city has increased over 25 per cent.; so that in each successive year the inadequacy of the water supply has become more and more serious.

The city can receive through the present aqueduct no more than it now conveys; hence as the population increases the average supply per head must decrease, and the pressure or elevation at which water can be delivered to consumers will constantly diminish. The time is not far distant when the supply will not, in many localities, rise above the basement, while in some situations the water will be almost wholly cut off. A few years since the water in some localities would run on the fourth floor; a little later barely on the third floor; now in the same house it will hardly flow on the second floor, and in a year or so it will not rise above the basement, which is the case already at times in localities not favored with high service.

This diminution of head is due solely to the fact that in its rapid growth the city has outrun its water supply.

The distinguished constructor of the aqueduct did not anticipate the great increase in the demand for water brought about by the requirements of modern life, the enormous growth of manufactures in the city, the use already of probably between 7,000 and 8,000 steam boilers within the city limits, the steam railways in operation already consuming over one million of gallons daily, nor the provision in every house of water fittings—often including pumps—from the basement to the upper floors.

New York city is now the largest manufacturing center in the United States. Its manufactories, warehouses, office buildings have increased in a much higher ratio than the population. Many of the users of these buildings reside out of New York, and the census returns place them on the roll of other cities. It has been estimated by competent authority that the floating population of the city, meaning those who do business here and reside elsewhere, as well as those who are temporary residents at hotels and boarding houses, is upward of 200,000. These are not included in the official census of the city, and if added would make the actual population nearly 1½ millions. Again, the commerce of the port is represented by a tonnage so vast that it could not have been anticipated 40 years ago, when our single aqueduct was built. Every large building is provided with elevators operated by steam engines which use great quantities of water.

The history of the water supply of modern cities, since the use of steam power became general, shows conclusively that the necessary consumption of water increases in a much higher ratio than the population.

Regarding the large reservoir in Central Park, proper caution demands that it should be kept as nearly full as possible, the principal object in the construction of this reservoir was to keep an available supply of water in case a break should occur in the aqueduct, making it necessary to shut off the water for examination and repairs. To draw off the water from the aqueduct, and again to renew its delivery into the reservoir, revuires nearly three days; should a break occur, the time consumed in repairing it must be added to this. Such an accident happening when the park reservoir is largely drawn down might be far more than an inconvenience; in case of a large fire, it might be a calamity of the most appaling character; the destruction of property might easily in a few hours be far more than the cost of an additional aqueduct. Therefore it is clear that the supply of water within the city should be maintained as near its maximum as possible, even if some localities, such as high points in the ordinary service, do suffer inconvenience from an occasional deficiency.

Under the circumstances, two things are of vital importance—first, the existing works must be kept in the most efficient condition possible; second, every effort must be made to enforce economy in the use of water, and to prevent its waste.

Only by this course can the city water supply be made to serve with the least inconvenience until additional works are constructed.

This loss of head, if it occurred only in those houses and establishments which waste water to a reckless extent might be considered a just retribution for their wastefulness, but, unfortunately, various classes of people, especially the laboring and others of moderate means, who are obliged to occupy upper stories, suffer to a much greater extent than is generally imagined, many having their supply wholly cut off, and others finding theirs growing less and less, with all the evils attendant upon such a state of things, as will no doubt be fully shown by the Health Department.

The works now in progress on the Bronx and Bryam rivers—besides addi-

tional storage reservoirs there—can probably be relied upon to furnish from 15 to 16 millions of gallons daily, as shown by a report on the subject made by Col. J. W. Adams at my request. It will probably require three years to complete them; by that that time we shall be but little, if indeed any better off than we are now. This new supply is so small that the rapid increase of population and manufacturies will soon catch up with it; in fact, it scarcely equals the present deficiency. It should, moreover, be stated that the Bronx and Byram supply will, for the most part, be available only for the new wards; but a small portion of it can be turned into the present aqueduct. Were it not for the fact that the ordinary inclination of the surface of the water in the lower part of the aqueduct is greater, in consequence of the change made at High Bridge, than it is above, no more water could be put into its lower part.

The following table shows the population of the city of New York, from 1870 to 1880, with estimates to 1885:

| Year. | Population. |
|---|---|
| 1870 | *942,292 |
| 1871 | †954,636 |
| 1872 | †967,142 |
| 1873 | †979,811 |
| 1874 | †992,646 |
| 1875 | ‡1,041,886 |
| 1876 | §1,072,934 |
| 1877 | §1,104,907 |
| 1878 | §1,137,833 |
| 1879 | §1,171,740 |
| 1880 | ‖1,206,577 |
| 1881 | §1,242,533 |
| 1882 | §1,279,560 |
| 1883 | §1,317,691 |
| 1884 | §1,356,958 |
| 1885 | §1,397,395 |

* U. S. Census of 1870.

† Estimated at annual rate of increase of 1.31 per cent., based upon total increase between U. S. Census of 1870, and New York State Census of 1875.

‡ New York State Census of 1875, including population of annexed district, 36,794.

§ Estimated at annual rate of increase of 2.98 per cent., based upon total increase between N. Y. State Census of 1875, and U. S. Census of 1880.

‖ U. S. Census of 1880.

The reports of the Department show that in 1852, when very much less water came through the aqueduct than now, the population being very much smaller, some ninety gallons per head was consumed. At that time the hydrants were allowed to run, the luxury of washing streets and sidewalks was indulged in to a greater extent than now, and water was used in every possible way.

I have stated that the existing works ought to be maintained in the most efficient condition possible Shortly after assuming the duties of this office, I requested Mr. G. W. Birdsall, First Assistant Engineer, to report the condition of the water service in the city, and make such recommendations as he might think proper for alterations or repairs to pipes and appurtenances. Mr. Birdsall accordingly stated many things which require attention; the most important being the condition of the double line of six feet cast iron mains, laid in 1866 to replace the masonry aqueduct from Ninetieth to Eighty fifth streets and Ninth avenue, through the Central Park to the old receiving reservoir. Many of the pipes broke soon after being laid, owing probably to the settlement of the streets. One of these lines was abandoned some time since, and is now partly taken up; the other was repaired about two years ago, but less than one-third of the quantity it should deliver is now running through it into the old receiving reservoir, which is, in consequence of having such an inadequate connection with the aqueduct, almost wholly useless. It is of the first importance that sufficient conduits should be laid to connect this reservoir with the aqueduct, not till then will it be an important adjunct to the service in the city, by shortening the time of recovering the head, when the water in the large reservoir has been drawn down.

The capacity of the small reservoir being about 150 millions of gallons, whilst the capacity of the large one is about 1,000 millions gallons, if the full delivery of the aqueduct can be turned into the former, the time required to recover the Lead, other things being equal, would be less than one-sixth of what it is under the present condition of things. This condition will be somewhat ameliorated by the completion of the four-feet main now being connected with the large pipes on the Tenth avenue and the old receiving reservoir. I do not propose to abandon these six-feet mains before making a thorough examination to see if it is not possible to strengthen them so that it will be safe to use them to their full capacity, as intended.

I requested Mr. B. S. Church, Resident Engineer, to report the condition of the aqueduct and suggest such repairs and improvements as his experience showed would add to its safety and efficiency. Mr. Church made several important recommendations, notably a plan for strengthening the aqueduct on the most dangerous places on its line, where it crosses valleys on embankments and where it has settled and cracked. These locations will always be a source of anxiety until they are thoroughly strengthened. He also suggests a method of shutting off the water from sections of a few miles so that repairs can be affected without emptying its entire length.

As you are aware, I have with your concurrence taken steps to have these necessary improvements carried out as soon as practicable.

The following figures show the average daily waste of water over the Croton Dam from the year 1868 to 1880, and is of the utmost importance in any estimate that may be made of the available supply from the Croton watershed, which vital question I am now studying with Mr. E. S. Chesbrough—

Average daily waste in U.S. gallons per year—1868, 504,424,000; 1869, 327,300,000; 1870, 256,325,000; 1871, 250,680,000; 1872, 205,005,000; 1873, 403,582,000; 1874, 249,750,000; 1875, 289,777,000; 1876, 259,327,000; 1877, 243,661,000; 1878, 334,140,000; 1879, 250,300,000; 1880, 146,233,000.

It is probable that with adequate storage and an aqueduct of sufficient capacity to carry it, at least 200 millions of gallons per day—more than twice our present supply—may be relied upon to be delivered into the city in the driest years of which we have any record.

With respect to its water supply, this city is having the same experience that every large city has had; the quantity originally provided for being found inadequate, measures are taken to secure an increased supply.

In Baltimore, Philadelphia, Boston, Cincinnati, St. Louis, and Chicago additional works have been found necessary and carried out. The demand in this city must be met by the construction of a new aqueduct. It cannot be urged to strongly that a city of such great and constantly increasing magnitude as New York should not rely upon one avueduct only. No other city of equal importance in Cristendom is so dependent upon a single engineering structure. A liberal supply of pure water is as important as sunlight; and I believe it is the sense of the community that such a fupply should be led into the city as soon as it is possible to do so.

Other interesting points might have been mentioned, but I have not thought it necessary to embody them in this general report.

Respectfully submitted,

ISAAC NEWTON, *Chief Engineer.*

Having studied this subject carefully for upward of a month, I concur with Mr. Newton in the foregoing statements and recommendations—above all, in reference to the great importance of beginning as soon as practicable the construction of a new aqueduct. E. S. CHESBROUGH.

## The Water Supply of the City.

The following is an extract from the report made to the Mayor by the Commissioner of Public Works, Hubert O. Thompson, for the quarter ending September 30, 1881, about the Croton water supply.

The rainfall in the Croton water-shed for July, August and September was only 4 91-100 inches, one-half of that for the same months of 1876, which was one of the driest years up to that time, and one-third less than in any year since a continuous record of the rainfall has been kept. Of this small quantity of rain, 1 77-100 inches fell during the first twelve days in July, while water was yet running over the Croton dam leaving only 3 14-100 inches for the remaining 80 days. On the 18th of July the natural flow of the Croton ceased to furnish the 95,000,000 gallons a day, which is the normal quantity sent through the aqueduct, and the limit of its capacity, and it continued to diminish to the close of the quarter, when it was less than ten millions gallons per day. During this time 5,575,000,000 gallons of water were drawn from the storage reservoirs and lakes to supply the deficiency, being an average of over 76,000,000 gallons a day.

The experience of the great drought shows that the capacity for storing water in the Croton basin is still inadequate to afford positive assurance that the aqueduct will at all times be supplied to its full capacity. The Commissioner has therefore ordered steps to be taken toward the acquisition of the land for another reservoir on the east branch of the Croton. The recent experiences furnished no reason to doubt the statements heretofore made in the reports of the department that the Croton water-shed is capable of furnishing a daily supply of over 200,000,000 gallons. All that is needed to insure such a supply is sufficient storage room to retain the water in time of abundant rainfall, to be drawn upon when the natural flow of the Croton river is insufficient. There is an abundance of available sites with natural advantages for storage reservoirs to supply this want.

In extending the water service 21,355 lineal feet of pipe were laid and 143 new fire hydrants set during the quarter, increasing the total length of Croton pipes to 509 16-100 miles, with 6,325 fire hydrants. 412 additional water meters were placed, making the total number in use on the 30th of September, 5,070. To obtain some evidence of the waste of water in private houses

during the hours from midnight to 6 A.M., a system of inspection was established to observe the flow of water from houses into the sewers at these hours, when there can be scarcely any legitimate use for water. The result of 426 examinations was as follows;

311 houses, flow of water less than 1 gallon a minute.
102 houses, flow of water 1 to 5 gallons a minute.
11 houses, flow of water 6 to 15 a gallons a minute,
2 houses, flow of water 30 gallons of water a minute.

This shows an inexcusable and wanton waste, amounting in the aggregate throughout the city to an enormous quantity, and demonstrates the necessity of some measure or appliance to control the waste in private houses. When it became necessary in consequence of the drought to reduce the consumption below the capacity of the aqueduct, 95,000,000 gallons a day, it could only be accomplished by shutting down the reservoir outlet gates, after stopping the public fountains and drinking hydrants, street sprinkling, the use of hose in washing sidewalks and house fronts, and exhausting every other measure available to the department to curtail the consumption. Many people may have considered these restrictive measures a great hardship to them, but a little reflection will show them that it is a simple arithmetical problem to prove that in a few years, with the present increase of population, and the capacity of the present aqueduct as the limit of our supply, the conditions which prevailed during the late crisis will become permanent, until relieved by an additional supply from a new aqueduct. If the severe lesson thus administered has impressed them and the authorities, to whom the department must look for means and power to maintain a sufficient supply of water, with the necessity for immediate steps to increase the supply, and of greater economy in the use of water during the years it will take to build the necessary works, it will have accomplished much good. —N. Y. *Tribune*, Nov. 26.

## Discovery of a Well of Natural Gas in Cincinnati, Ohio.

Quite a sensation was created in the vicinity of Richmond and Carr streets day before yesterday by the striking of a strong flow of what appears to be pure burning gas. The discovery was made on the block of ground on which the coffin company is now reconstructing the buildings destroyed by fire some two months since. The exact point of this new phenomenon is about 100 feet east of Carr street and about 50 feet north of Richmond street.

After the big fire, and when the coffin company concluded to again build, it was suggested that an artesian well could be constructed at a comparatively small expense, and that the water could be utilized for many purposes.

The experiment was accordingly attempted, and the work was commenced about three weeks ago, a six inch pipe being used, and driven down as fast as the earth and stone obtained by the boring were removed.

At the depth of thirty-five feet water was struck, but as it was not of the kind desired, the boring was continued and carried to the depth of eighty-three feet, where a powerful stream of gas was struck. The boring tools before the volume of gas was struck, had gone through four distinct strata. The first was the ordinary gravel earth, the second blue limestone, the third blue clay, and the fourth light sandstone.

On Tuesday, when the workmen had reached the depth of eighty-three feet, a rumbling noise was heard, and it was discovered that the flow of water was not as heavy as it had been. Then there came a strong smell of gas, and Mr. Burgess, who was in charge of the work, seeing danger ahead, ordered the fire in the boiler of the engine which had been doing the boring drawn, and a "cap" put on the pipe, which had been driven down a distance of more than eighty feet. The cap was put on and riveted, but was torn off by the pressure of the gas in less than a half minute after it had been put in place.

It was then determined to test the quality of the gas, and a one-inch pipe forty-eight feet in length with two stop-cocks was procured; another and shorter pipe was procured and used for escape purposes. The pipes were put in position about three o'clock and the match applied to the longest and largest, which was one inch in diameter. The flame shot out for a distance of seven feet, producing a blaze equal to nearly 500 ordinary gas burners. It continued to burn all of Tuesday afternoon and night, all of yesterday, and when extinguished at dark last night seemed to have greater force than when first lighted.

At the force with which the flow was coming, a gentleman, well-versed in matters of the kind, said that it would only take sixty-four hours to fill the largest holder at the gas works. The gas is apparently pure, and white paper put in contact with it was not colored in the least.

Nearly 5,000 persons visited the place yesterday, and more may be expected to-day. The gas, it is said, comes from a bed of coal oil. Just how long it will hold its force is a matter of speculation only. but one a good many people are interested in.—Cinn. *Commercial*, Nov. 17.

## Fire Caused by the Electric Light.

About six o'clock last evening an alarm of fire was sounded from box 12, corner of Fifth avenue and Market street. The fire department responded, but it was not necessary for the engines to go into service. The alarm was caused by the wire which supplies the electric light to Messrs. Himmerich Bros., W. J. McMaster, and Fleishman Bros. coming into contact with the tin roofs of the buildings of the above firms. The electricity ran down the spouts and flew among the railings of the awnings and was a beautiful sight to behold. The fire that came down the spouts could not be compared to anything but molten gold. A fireman attempted to put down the light in front of W. J. McMaster's place, but the moment his hand touched the affair he was knocked flat on his back by the shock. Another one attempted to pick up an iron but it being charged with the electric fluid he dropped it quicker than he picked it up. The pavement was charged also, and a dog that belonged to one of the engines was shocked and it laid down on the pavement and rolled over and over, howling all the while, until a spectator got it away. A fireman went up on the tin roof which was in a blaze of fire, and he commenced to dance around in a comical manner. Chief Evans yelled up at him and asked him if he was drunk. "Drunk! thunder," said the fireman, "I can't keep still. Come up and try it yourself." The invitation was not accepted by the chief.

No damage was done further than that the light had to be turned off. Fire Marshal McFadden put in in an appearance shortly after and took a look at the lights.—Pittsburgh *Leader*, Nov. 20.

## The Krupp Gas Producer.

*La Genie Civil* prints an article in which the results of the competitive working of a Krupp and an old Siemens gas producer is given. A drawing is appended which, in the absence of any statement to that effect, we must suppose to be a section of the Krupp producer. From it it appears that the principal feature of that apparatus consists in the adoption of an annular iron appendage to the bottom of the charging apparatus in which the fuel is preheated before it reaches that portion where the conversion into gas actually takes place. We may add that in the same issue of *Le Genie Civil* an illustration is given of a new Siemen's producer, in which provision is made for the heating of the air for the partial combustion in the producer.

The trial above referred to showed that while the old Siemens producers converted into gas in 12 hours 1220 kilogrammes of gas coal from the Hanover colliery, which held from 6 to 7 per cent. of cinder, the Krupp producer gasified 1,500, and when pushed, even 2,000 kilogrammes of ordinary steam coal, holding 11.5 per cent. of ash, both kinds of producers being run by Körting injectors. The gas coal cost 10 francs per ton, while the steam coal could be bought for 5.25 francs.

The gas produced by the two styles of furnace was found to contain on an average the following—

| | Siemens. | Krupp. |
|---|---|---|
| Carbonic oxide | 18 per cent. | 25 per cent. |
| Hydrogen | 10 " | 12 " |
| Hydrocarbons | 2 " | 2 " |
| Carbonic acid | 6.8 " | 2.4 " |

Three workmen can attend to eight Krupp producers, and besides the reduced cost of fuel and labor, the cost of maintenance was found to be smaller.—*Review of Gas and Water Engineering.*

# Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

### The Control of Gas to the Point of Consumption.

INDIANAPOLIS GAS LIGHT AND COKE CO.,
INDIANAPOLIS, IND., Nov. 24, 1881.

Mr. Editor: Your article in the last issue, "On the Control of Gas to the Point of Consumption," is very much to the point. There can be no doubt that most of the troubles which affect gas companies can be traced to imperfect fittings and burners, and the only remedy, as you observe, is for the gas companies either to control or do the gas fitting themselves. There is one important item which you omitted to mention, and that is this. If the gas companies controlled the gas fitting they would not have to carry one-half the pressure which they are now obliged to do. I need not point out the great benefits that would result to company and consumers alike, if such were the case. During the last three years we have sold and fitted up for use over one thousand gas stoves; and I venture to assert that if I had put this business into the hands of the gas fitters we would not to-day have one hundred stoves in use, and the reason is simply this—the gas fitter has no interest whatever in supplying gas either for lighting or heating purposes.

Yours, very truly,
JAS. SOMERVILLE.

THE AMERICAN GAS LIGHT JOURNAL

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FRIDAY, DECEMBER 2, 1881.

## Official Report of Examinations of Gas for three Weeks ending Nov. 26, 1881, made at the Photometrical Room of the Department of Public Works.

### Corrected Illuminating Power.

| 1881. Nov. | Time of Day at which Test were made. | New York Gas Light Co. | Manhattan Gas-Light Co. | Mutual Gas-Light Co. | Metropolitan Gas-Light Co. | Harlem Gas-Light Co. | Municipal Gas-Light Co. |
|---|---|---|---|---|---|---|---|
| | | † | * | † | ‡ | * | † |
| 7 | Between | 25 03 | 19.28 | 25.36 | 22.72 | 18.54 | 29.29 |
| — | 9.30 A.M. | | | | | | |
| 9 | and | 25.40 | 18.38 | 23.09 | 21.92 | 20.01 | 31.63 |
| 10 | 1 P. M. | 23.40 | 19.88 | 24.63 | 22.30 | 19.18 | 31.06 |
| 11 | | 23.34 | 20.15 | 25.61 | 22.07 | 18 39 | 30.93 |
| 12 | | 24.25 | 19.86 | 24.73 | 22.51 | 18.52 | 28.96 |
| | Average | 24.28 | 19 51 | 24.68 | 22.30 | 18.93 | 30.37 |
| 14 | | 23.48 | 18.88 | 27.80 | 25.66 | 19.36 | 29.89 |
| 15 | | 24.48 | 19.22 | 27.56 | 23.79 | 19.01 | 30.15 |
| 16 | | 27.81 | 19.52 | 25.01 | 23.63 | 19.38 | 29.14 |
| 17 | | 25.08 | 19.40 | 24.89 | 24.03 | 19.54 | 29.63 |
| 18 | | 25.99 | 19.23 | 24.13 | 22.48 | 18.54 | 29.57 |
| 19 | | 28.89 | 19.55 | 27.32 | 23.24 | 19.16 | 30.90 |
| | Average | 25.62 | 19.30 | 26 12 | 23.47 | 19.16 | 29.88 |
| 21 | | 25.82 | 18.86 | 22.42 | 21.87 | 19.64 | 29.92 |
| 22 | | 25.21 | 19.36 | 22.12 | 22.01 | 18.79 | 29.25 |
| 23 | | 23.91 | 19.25 | 24.59 | 22.32 | 18.71 | 29.46 |
| — | | | | | | | |
| 25 | | 27.44 | 19.61 | 20 62 | 20.98 | 18.15 | 27.65 |
| 26 | | 21.46 | 18.20 | 23.91 | 21.72 | 18.35 | 27.86 |
| | Average | 24.77 | 18.93 | 22.69 | 21.78 | 18.73 | 28.83 |

* Five foot lava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.

E. G. LOVE, Gas Examiner.

## Niagara Falls as a Source of Energy.

Sir William Thomson thus sums up, in his British Association address, the conclusions he has reached in regard to the utilization of the energy of Niagara Falls:

"1. Apply dynamos driven by Niagara to produce a difference of potential of 80,000 volts between a good earth connection and the near end of a sold copper wire of half an inch (1.27 centimeters) diameter, and 300 statute miles (483 kilometers) length.

"2. Let resistance by driven dynamos doing work, or by electric light, or, as I can now say, by a Faure battery taking in a charge, be applied to keep the remote end at a potential differing by 64,000 volts from a good earth plate there.

"3. The result will be a current of 240 webers through the wire taking energy from the Niagara end at the rate of 26,250 horse power, losing 5,250 (or 20 per cent.) of this by the generation and dissipation of heat through the conductor, and 21,000 hower (or 80 per cent. of the whole) on the recipients at the far end.

"4. The elevation of temperature above the surrounding atmosphere, to allow the heat generated in it to escape by radiation and be carried away by connection is only 20° C.; the wire being hung freely exposed to air, like an ordinary telegraph wire supported on posts.

"5. The striking distance between flat metallic surfaces with difference of potentials of 80,000 volts (or 5,000 Daniell's) is only 18 millimeters, and therefore there is no difficulty about the insulation.

"6. The cost of the copper wire, reckoned at 8d. per pound, is £37,000, the interest on which at five per cent. is £1 900 a year. If 5,250 horse power at the Niagara end costs more than £1,900 a year, it would be better economy to put more copper into the conductor; if less, less."—*Nature.*

## Preparation of Pure Phenol.

W. Alexejeff recommends adding to the commercial carbolic acid 5 per cent. of water, melting the mixture and setting aside to crystallize. The crystals are well drained and the operation is repeared two or three times, when the final product is distilled.

The author has been unable to prepare the hydrate, $2PhHO+H_2O$, which Calvert stated to be obtained from a mixture of 4 parts of phenol and one part of water at a temperature less than 4° C., and to melt at 16° C. Left in contact with an excess of water for several months, the author obtained crystals melting at 37° C.—*Ball. Soc. Chem.*

## Improvement in Compasses.

Miller and Pfaundler have devised a method for reading the indications of the compass with great accuracy. The magnetic needle carries near its ends two thin discs of aluminum; upon each of the discs a fine line is drawn so as to indicate the plane in which the pivot of the needle stands. A microscope and vernier are attached, together with a small disc of paper or mica, which stands perpendicularly upon the needle, so as to bring it more speedily to rest by means of the resistance of the air.—*Dingler's Journal.*

**Size for Improving Poor Drawing Paper.**—Take 1 oz. of white glue, 1 oz. of white soap, and ½ oz. of alum. Soak the glue and the soap in water until they appear like jelly; then simmer in 1 qt. of water until the whole is melted. Add the alum, simmer again and filter. To be applied hot.

## Gas Stocks.

**Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.**
**(with W B Scott & Co.,)**
34 PINE STREET, NEW YORK CITY.

DECEMBER 2, 1881.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share. ☜

| | Capital. | Par. | Bid. | Asked |
|---|---|---|---|---|
| *Gas Co.'s of N. Y. City.* | | | | |
| Central | $466.000 | 50 | 70 | 75 |
| Harlem | 1,800,000 | 50 | 90 | 93 |
| " Bonds | 170,000 | | | 103 |
| Manhattan | 4,000,000 | 50 | 215 | 220 |
| Metropolitan | 2,500,000 | 100 | 150 | 153 |
| " Bonds | 658,000 | .. | 107 | 110 |
| Mutual | 5,000,000 | 100 | 78 | 81 |
| " Bonds, go'd. | 900,000 | 1000 | 100 | 104 |
| Municipal | 1,500,000 | 100 | 175 | 178 |
| " Bonds | 750,000 | | 106 | 110 |
| New York | 4,000,000 | 100 | 104 | 105x |
| Northern | 270,000 | 50 | — | 100 |
| *Gas Co's of Brooklyn.* | | | | |
| Brooklyn | 2,000,000 | 25 | 122 | 125 |
| Citizens | 1,200,000 | 20 | 57 | 59 |
| " S. F. Bonds. | 320,000 | 1000 | 105 | 109 |
| Fulton Municipal | 1,500,000 | 100 | 68 | 72 |
| Peoples | 1,000,000 | 10 | 30 | 35 |
| " Bonds | 290,000 | . | 101 | 104 |
| " " | 250,000 | ... | 70 | 75 |
| Metropolitan | 1,000,000 | 100 | 68 | 72 |
| Nassau | 1,000,000 | 25 | 68 | 70 |
| " Ctfs. | 700,000 | 1000 | 95 | 100 |
| Williamsburgh | 1,000,000 | 50 | 65 | 70 |
| " Bonds | 1,000,000 | ... | 98 | 103 |
| Richmond Co., S. I. | 300,000 | 50 | 70 | 75 |
| " Bonds | 40,000 | — | — | — |
| *Out of Town Gas Companies.* | | | | |
| Buffalo Mutual, N.Y | 750,000 | 100 | 72 | 76 |
| " Bonds | 200,000 | 1000 | 95 | 100 |
| Citizens, Newark | 918,000 | 50 | 85 | 90 |
| " " Bds. | 124,000 | — | 105 | 10 |
| Chicago Gas Co., Ills | | | 125 | — |
| Cincinnati G. & C. Co. | | | 178 | 180 |
| Consolidated, Balt. | | | 43 | 44 |
| Bonds | | | 107 | — |
| East Boston, Mass | | 25 | 111 | 120 |
| Hannibal, Mo | 100.000 | 100 | 95 | 100 |
| Hartford, Conn | 700,000 | 25 | 140 | 144 |
| Halifax N. S | 400,000 | 40 | 148 | 150 |
| Hamilton, Ontario | 150.000 | 40 | 117½ | |
| Jersey City | 750,000 | 20 | 155 | 160 |
| Jacksonville, Ill | 120,000 | 50 | 100 | ... |
| Lewistown Maine | 400,000 | 100 | — | 100 |
| Laclede St Louis Mo | 1,200,000 | 100 | 108 | 110 |
| Montreal, Canada | 2,000,000 | 100 | 153 | 154 |
| New Haven, Conn | | 25 | 132 | — |
| Oakland, Cal | | | 32 | 33 |
| Peoples, Jersey City | | ... | 95 | 100 |
| " " Bds. | | | | 5 |
| Pittsfield, Mass | | | 120 | 130 |
| Rochester. N. Y | | 50 | 70 | 80 |
| " Citizens | | 100 | 30 | 35 |
| Wilmington, Del | | 50 | 174 | ... |
| Yonkers | | 50 | 30 | 32 |
| St. Louis Missouri | 600,000 | 50 | 250 | 254 |
| San Francisco Gas-Co., S. Fr'isco Cal. | | | 68 | 69 |
| Toledo, Ohio | | | 95 | 97 |
| Troy, Citizens | 600,000 | 100 | — | — |
| Washington, D. C | 1,500,000 | 20 | 185 | 200 |
| " Scrip | 375,000 | 15 | 200 | 206 |

Sold at auction, Nov. 30, 100 shares Manhattan at 214; 17 shares Manhattan at 217½; $1000 bond of Williamsburgh gas light company, at 100½; 64 shares Nassau, of Brooklyn, at 67½.

## Advertisers Index.


| | Page |
|---|---|
| **GAS ENGINEERS.** | |
| William Farmer, New York City | 262 |
| G. Warren Dresser, New York City | 256 |
| **GAS WORKS APPARATUS AND CONSTRUCTION.** | |
| Herring & Floyd, New York City | 259 |
| T. F. Rowland, Greenpoint, L. I | 259 |
| Delly & Fowler, Phila., Pa | 259 |
| Kerr Murray Mfg. Co., Fort Wayne, Ind | 259 |
| Stacey Mfg. Co., Cincinnati, Ohio | 259 |
| Bartlett, Hayward & Co., Baltimore, Md | 259 |
| P. Munzinger, Phila., Pa | 259 |
| Brown & Owen, Phila., Pa | 259 |
| Morris, Tasker & Co., Limited, Phila., Pa | 259 |
| **GAS AND WATER PIPES.** | |
| A. H. McNeal, Burlington, N. J | 258 |
| Gloucester Iron Works, Phila., Pa | 258 |
| R. A. Brick, New York City | 258 |
| James Marshall & Co., Pittsburgh, Pa | 258 |
| R. D. Wood & Co., Phila., Pa | 258 |
| Warren Foundry and Machine Co., Phillipsburgh, N. J | 258 |
| Mellert Foundry and Machine Co., Reading, Pa | 258 |
| **WASHERS AND SCRUBBERS.** | |
| G. Shepard Page, New York City | 254 |
| **RETORTS AND FIRE BRICK.** | |
| J. H. Gautier & Co., Jersey City, N. J | 256 |
| B. Kreischer & Sons, New York City | 256 |
| Adam Weber, New York City | 256 |
| Laclede Fire Brick Works, St. Louis, Mo | 256 |
| Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y. | 256 |
| Borgner & O'Brien, Phila., Pa | 256 |
| Gardner Brothers, Pittsburgh, Pa | 256 |
| Henry Maurer, New York City | 256 |
| Evens & Howard, St. Louis, Mo | 256 |
| **DIETERICH'S REGENERATOR FURNACE.** | |
| Charles F. Dieterich, Baltimore, Md | 238 |
| **GAS METERS.** | |
| Harris, Griffin & Co., Phila., Pa | 262 |
| American Meter Co., New York and Philadelphia | 263 |
| The Goodwin Gas Stove and Meter Co., Philadelphia, Pa | 263 |
| Helme & McIlhenny, Phila., Pa | 263 |
| **GAS STOVES.** | |
| The Goodwin Gas Stove and Meter Co., Phila. Pa | 264 |
| American Meter Co., New York and Philadelphia | 255 |
| **VALVES.** | |
| Ludlow Valve Manufacturing Co., Troy, N. Y | 257 |
| Chapman Valve Manufacturing Company, Boston, Mass | 256 |
| **EXHAUSTERS.** | |
| P. H. & F. M. Roots, Connersville, Ind | 257 |
| Smith & Sayre Manufacturing Co., New York City | 257 |
| **GAS COALS.** | |
| Penn Gas Coal Co., Phila., Pa | 261 |
| Perkins & Co., New York City | 260 261 |
| Cannelton Coal Co., New York and Philadelphia | 261 |
| New York and Cleveland Gas Coal Co., Pittsburg Pa | 261 |
| Newburgh Orrel Coal Co., Baltimore, Md | 261 |
| Despard Coal Co., Baltimore, Md | 261 |
| Fort Pitt Gas Coal, Pittsburgh, Pa | 260 |
| Chesapeake and Ohio R.R. Coal Agency, N. Y. City | 261 |
| **GAS ENGINES.** | |
| Schleicher, Schumm & Co., Phila., Pa | 230 |
| **STEAM STOKERS.** | |
| A. Q. Ross, Cincinnati, Ohio | 240 |
| **PURIFIER SCREENS.** | |
| George D. Cabot, Lawrence, Mass | 229 |
| **BURNERS.** | |
| G. Gefroter, Phila., Pa | 256 |
| **PURIFYING MATERIAL.** | |
| Connelly & Co., New York City | 257 |
| **STEAM BLOWER FOR BURNING BREESE.** | |
| H. E. Parson, New York City | 230 |
| **PROCESSES.** | |
| Gwynne Harris New York City | 258 |
| Strong Gas and Fuel Co., Yonkers, N. Y | 254 |
| **EDGE'S PROCESS. REMOVING CARBON** | |
| D. D. Flemming, Jersey City, N. J | 257 |
| **GAS FIXTURES.** | |
| Mitchell, Vance & Co., New York City | 257 |
| **CEMENT.** | |
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| Gas Analyst's Manual | 260 |
| Scientific Books | 258 |
| Cathels' Gas Consumers' Manual | 263 |
| Fodell's Book-Keeping | 263 |
| Review of Gas and Water Engineering | 263 |



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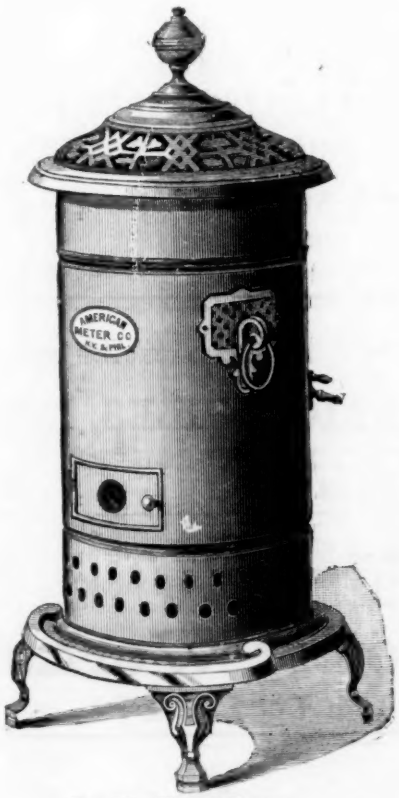


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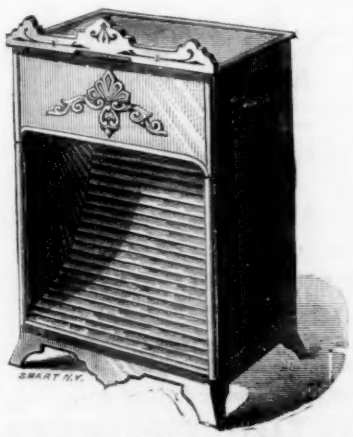


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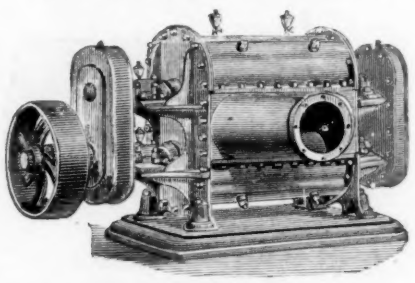

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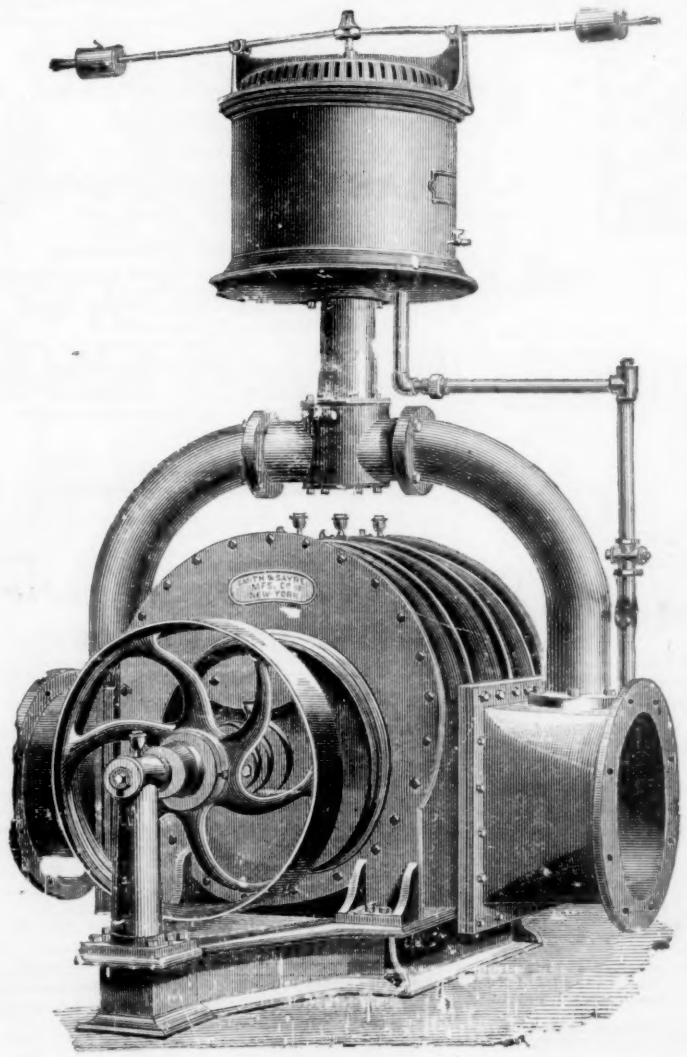


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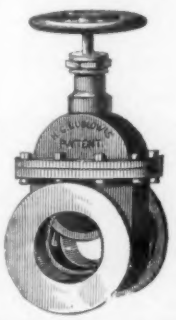


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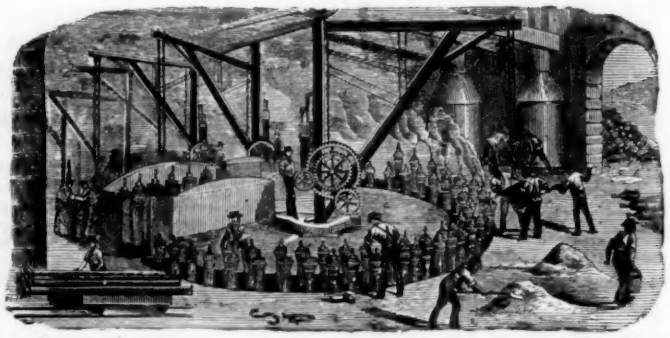

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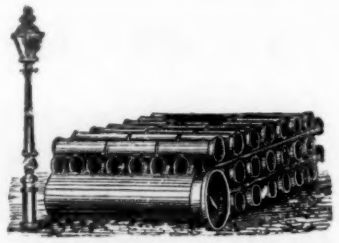

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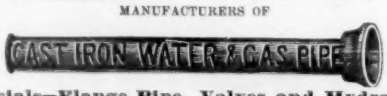


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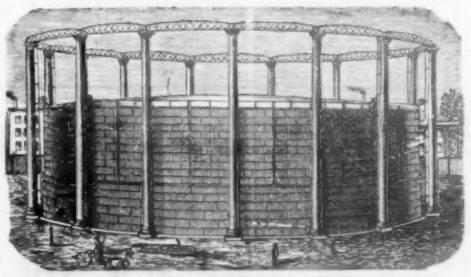

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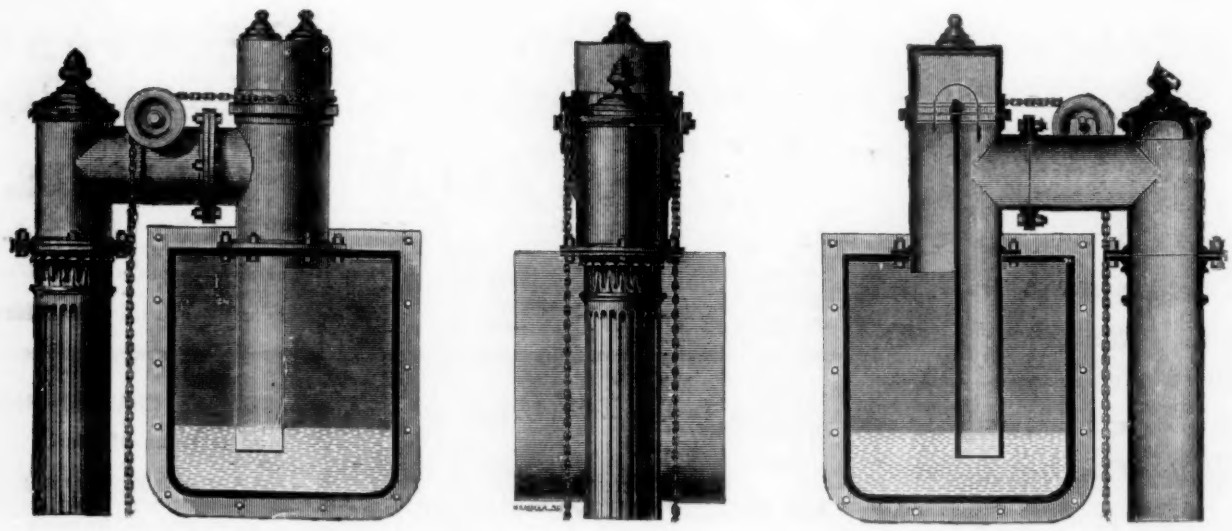

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